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MERAMEC RIVER BASIN MISSOURI

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U. S. DEPARTMENT OF AGRICULTURE REPORT

PREPARED BY

SOIL CONSERVATION SERVICE
ECONOMIC RESEARCH SERVICE
FOREST SERVICE
STATE OF MISSOURI

1966

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UNITED STATES DEPARTMENT OF AGRICULTURE

SOIL CONSERVATION SERVICE

Field Advisory Committee
Meramec River Basin
Columbia, Missouri 65201

April 1, 1966

Honorable Warren E. Hearnes
Governor of Missouri
Jefferson City, Missouri

Dear Governor Hearnes:

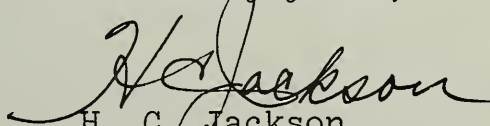
The attached United States Department of Agriculture report presents information regarding opportunities for water and related land resource development in the Meramec River Basin. The Department of Agriculture participated in this cooperative survey with the State of Missouri in response to a request from its Governor, dated November 4, 1963.

The Department of Agriculture's participation in the survey was under the provisions of Section 6, Public Law 566, 83rd Congress, as amended. It authorized the Department to cooperate with other Federal, State, and local agencies in making investigations and surveys of watersheds within a river basin as a basis for the development of coordinated programs.

The survey presents information obtained from cooperative investigations by the Economic Research Service, Forest Service, and Soil Conservation Service of the Department of Agriculture and by the State of Missouri.

This report of an investigation and survey covers the assignment of the Department of Agriculture as provided in the Plan of Work for the Meramec River Basin study.

Sincerely yours,



H. C. Jackson
State Conservationist
Soil Conservation Service
and Chairman
USDA Field Advisory Committee

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EXECUTIVE OFFICE
STATE OF MISSOURI
JEFFERSON CITY

JOHN M. DALTON
GOVERNOR

November 4, 1963

Honorable Orville L. Freeman
Secretary of Agriculture
Washington 25, D. C.

Dear Mr. Secretary:

The State of Missouri wishes to make full and constructive use of the waters originating within its boundaries and of the lands related to them. The Corps of Engineers has recently studied opportunities for developments on the Meramec River and has given consideration to some possible developments in up-stream areas.

The State of Missouri wishes to obtain the cooperation of the Department of Agriculture in a study of the watershed of the Meramec River looking toward appropriate coordinated development of upstream and main stem water resources of the basin.

I, therefore, officially request the cooperation of the U. S. Department of Agriculture, under the provisions of Section 6 of Public Law 566, with the State of Missouri in making an investigation and survey of the Meramec River Basin, with particular emphasis on the agricultural, rural, and upstream areas in the basin.

In submitting this request, the State of Missouri would, through its Water Resource Board, assume the leadership as a sponsor of the study involving the total resources of the Basin including the responsibilities assigned from the Department of Agriculture to other cooperating State and Federal Agencies.

Sincerely yours,

/s/ John M. Dalton

Governor

MERAMEC RIVER BASIN REPORT

Missouri



COURTESY "MISSOURI FARMER"

Prepared by

U.S. DEPARTMENT OF AGRICULTURE

Soil Conservation Service

Economic Research Service

Forest Service

STATE OF MISSOURI

Water Resources Board

April, 1966

ACKNOWLEDGMENT

Valuable information for this U.S. Department of Agriculture report was provided through assistance and reports by local, State, and Federal agencies. The following are acknowledged for their assistance:

U.S. Army Engineers, District of St. Louis
U.S. Geological Survey, Surface Water Branch
U.S. Fish and Wildlife Service
U.S. Bureau of Outdoor Recreation
U.S. Bureau of Mines
U.S. Bureau of Census
U.S. Agriculture Stabilization and Conservation Service
University of Missouri
University of Missouri Extension Service
Missouri Water Resources Board
Missouri Water Pollution Board
Missouri Park Board
Missouri Geological Survey and Water Resources
Missouri State Highway Department
Missouri Conservation Commission
Missouri Division of Health
Missouri Commerce and Industrial Development
Missouri Soil and Water District Commission
Basin Soil and Water Conservation Districts
Meramec Basin Corporation
Meramec Basin Association
St. Louis County Planning Commission
Jefferson County Planning Commission

CONTENTS

SUMMARY	i
I. INTRODUCTION	1
Authority	1
Participants	1
Objectives	2
II. DESCRIPTION OF BASIN	3
Location and Size	3
Climate	3
Topography	4
Geology and Soils	4
Land Use	8
III. ECONOMIC DEVELOPMENT AND ACTIVITY	11
Population	15
Employment	17
Agricultural Production and Income	18
Related Income	23
Problems	24
IV. RESOURCE USE AND DEVELOPMENT	28
Land	28
Water	38
V. NEEDS FOR RESOURCE DEVELOPMENT	43
Land	43
Water	51
VI. PROJECTIONS OF RESOURCE USE AND ECONOMIC DEVELOPMENT	57
Land Use and Management	57
Water	65
Emerging Problems	68
VII. PROGRAM AND PROJECT OBJECTIVES	71
Economic Development	71
Land Treatment	71
Water Resource Development	72

CONTENTS
(Continued)

VIII.	PROPOSED PROGRAMS AND PROJECTS	74
	Land Treatment Program	74
	Water Resource Development	80
	Map - Structure Locations	89
	Map - Nonagricultural Reservoir Sites	91
	Map - Potential P.L.-566 Projects	93
IX.	IMPACTS OF PROPOSED PROGRAMS AND PROJECTS	95
	Physical	95
	Economic	96
	Project Benefits and Costs	99
X.	APPENDIX	105

U.S. DEPARTMENT OF AGRICULTURE

MERAMEC RIVER BASIN, MISSOURI

SUMMARY

Basin Problems

The principal problems in the Meramec River Basin are: (1) the lack of organized Soil and Water Conservation Districts to implement a program of land use, treatment, and management on the land in farms and on that land directly associated with structural measure development, (2) the flooding of bottom land in agricultural use, and (3) the underdevelopment of water and related land resources.

Flood damage amounts to an estimated annual average of \$2 million. About 162,000 acres of good land are subject to flooding--85,000 acres on the tributaries and 77,000 acres on the main river flood plains. Several small towns on the tributaries are flooded.

Since the flood plains contribute most of the grain and forage on many farm units, floodwater damage to agricultural crops reduces farm income and affects the entire agricultural economy of the Basin.

The demand for water-based recreational activities by residents of the Basin and metropolitan St. Louis is much greater than the present supply. Present recreation facilities, mostly land-based, furnish about 6,000,000 recreation days annually. The currently available recreation facilities provide only 55 percent of the 1960 demands and will provide only 25 percent of the 1980 demands.

Small towns in the upper Basin get their water supply primarily from ground water. Water for livestock is supplied from wells, farm ponds, streams, springs, or from some combination. No future shortage is anticipated.

In the lower Basin, with a high density of dwelling units and where deep ground water is highly mineralized, individual homes have difficulty in obtaining water. A future shortage of quality water is anticipated as the population increases.

The Report

This report by the U.S. Department of Agriculture is part of a comprehensive plan for development of the water and related land resources in the Meramec River Basin. It is based

upon a study of the tributary and upstream watersheds, of the need for flood prevention, and of the public demand for development and conservation of the Basin.

The study was made under the provisions of Section 6 of the Watershed Protection and Flood Prevention Act (Public Law 566, 83rd Congress, as amended). It was carried out in cooperation with the St. Louis District of the U.S. Army Corps of Engineers and the State of Missouri. Information is compiled on the use and control of water for agriculture in the Basin. It pinpoints problems such as erosion and flooding, also uses for recreation, irrigation, and domestic supplies in the tributary watersheds. Studies were made on past uses of land and water to establish trends in order that program projections could be made from the present to year 2010.

Description of the Basin

The Basin has a total area of 3,980 square miles--2,547,000 acres--and includes all or parts of 15 counties. The average rainfall is 39 inches and the growing season is about 200 days. Elevations range from 400 to 1,400 feet mean sea level. The Meramec River is a tributary of the Mississippi River; the confluence is about 11 miles south of the city limits of St. Louis.

The topography ranges from broad ridges and gentle slopes to narrow ridges, steep slopes, and bluffs. The gently rolling country is in the north and west; steeply rolling country is in the southern-central area.

Shallow, cherty, or stony soils on rolling to steep slopes predominate. In the western, northern, and eastern areas of the Basin, a loessial cap from one foot to several feet deep covers the residual, basal material. Bottom-land soils are generally deep and well to moderately well-drained in the broader valleys. Small, alluvial valleys characterize the Basin. Soils in the more narrow valleys frequently have gravelly subsoils.

Woodlands make up about three-fifths of the Basin. About one-fifth of the land is cropland, one-fifth is in pasture or other uses. Almost 15 percent, including Clark National Forest, State forests, parks, recreation areas, and wildlife areas, is in public ownership.

The population is about 210,000; 70 percent is outside metropolitan St. Louis. The rural population is approximately 75 percent non-farmers and 25 percent farmers. By 1980 a total population of 340,000 to 490,000 is estimated--a twofold increase over 1960.

The Meramec River Basin has a diversified economy. About 12 percent of the working force is engaged in agriculture, 26 percent in manufacturing, 52 percent in services, 5 percent in mining, and 5 percent unemployed. About 20 percent of the workers residing in small towns and rural areas commute to their jobs, generally in the St. Louis metropolitan area. Income per farm varies from a gross of \$3,000 to \$10,000 per year.

Both agriculture and forestry make important contributions to the economy of the Basin. In 1960 the total value of farm crop production, livestock, and livestock products amounted to almost \$26 million. At the present time the timber industry contributes about \$12 million per year.

Basin Trends

Total land in farms declined 16 percent from 1939 to 1959 --from 1,544,214 acres to 1,303,720 acres. Farm units declined 40 percent faster than did the land in farms--from 11,413 to 6,787 units. The average size of a farm, however, increased from 135 acres to 192 acres.

These trends are expected to continue; the projections for 1980 are: land in farms 1,200,000 acres; average size of a farm 230 acres; and number of farms 5,200.

Principal grain-crop acres are expected to decline, but yields per acre are expected to increase. There will continue to be an increase in total production from 1980 to 2010.

Projections for 1980 indicate an average increase of 13.4 percent (\$2.2 million) in production with resource development. The same is true for livestock and livestock products. As a result of increased grains, hay and pasture, there will be an expected increase of \$12 million annually.

Fewer, but larger, farms, with continuing specialization and technological advances--including conservation farming--will raise agricultural yields. The forest lands will have a continuing economic and social influence. With proper use and development, the forest will provide an increasing supply of wood, water, wildlife, forage, and recreation benefits.

Population pressures will cause shifts in major land use to meet emerging demands for highways, railroads, airports, housing, industry, water impoundments, and recreation. Estimates show that from 7,000 to 10,000 acres of cropland, pasture, and forest lands will be diverted to these other uses annually for the next 50 years.

Water needs for rural users will be greater in the future to meet the demands of a growing population. However, domestic water needs on farms will probably remain constant although the number of farms is expected to decline. The rural non-farm population will increase and water demands will expand beyond available quality supply in the vicinity of St. Louis.

Results and Findings of the Study

The U.S. Department of Agriculture's program, as outlined, will improve land and water utilization; this improved use will enhance the existing beneficial returns to the people of the Basin, as well as the nation. It emphasizes accelerating land-treatment measures to reduce runoff, erosion, and sediment production. This recommended land treatment includes sound conservation measures, designed to protect and improve agriculture and woodlands, and to increase over-all farming efficiency. Urban expansion around St. Louis will present problems of sediment control that will require special attention and education of non-farm users.

Over 100 structure sites with water-storage potential for 3 to 4 inches of runoff from the contributing drainage areas were investigated. These sites, either singularly or in combination, were first studied in relation to needs and justification for flood prevention. Other purposes, such as recreation, were then considered and evaluated on the benefits they would provide.

In some instances, geological conditions precluded permanent water storage. Where this was not the case, the maximum practical storage potential for the flood-prevention sites was utilized by adding storage quantities for recreational purposes. Some of this added storage may be re-allocated to other uses, such as irrigation, municipal or industrial supply, and water quality, if these needs pre-empt the recreational use. Under present economic conditions irrigation is not feasible.

Potential for providing about 4,000 surface acres of recreation water within the Clark National Forest was investigated. The sites were evaluated in reference to the recreation benefits obtainable based on the water area and on the facilities which could be developed.

The development of the water and related land resources requires 60 reservoirs in the tributaries and headwaters of the Basin--30 multipurpose reservoirs for flood prevention and recreation, 14 for flood prevention alone, and 16 for recreation in the Clark National Forest.

Flood protection will be provided on 35,000 acres of bottom land for agricultural production and for present and future urban development. These 60 reservoirs will provide 10,200 acres of water for recreation and 11,000 acres of land for recreation facilities; they will have a total shoreline of 280 miles. When fully developed, these reservoirs will provide over 4,000,000 recreation days annually.

The system of proposed structures will cost an estimated \$27 million for reservoir construction and associated recreation facilities. Benefits are expected to exceed the installation cost.

There are opportunities for development of projects for watershed protection and flood prevention under Public Law 566 where qualified local sponsors take the initiative. These small watershed projects require sponsors with legal and financial authority to provide land, easements, and rights-of-way, for contractual aspects, and to assume operation and maintenance of works of improvements.

CONCLUSIONS

1. Continued population growth will cause greater competition for the land and water resources.
2. Agricultural production will continue to increase and will make substantial contributions to the economy of the area.
3. Increased agricultural benefits from the development of the land and water resources will be 25 to 30 percent greater over a 20-year period than without the developments.
4. Development of water and related land-resource benefits--both tangible and intangible--will accrue in substantial amounts from increased industry, recreation, and other activities.
5. The initiative and cooperation of local interests are major considerations and requirements for implementing the proposals of the U.S. Department of Agriculture.

U.S. DEPARTMENT OF AGRICULTURE

MERAMEC RIVER BASIN

MISSOURI

I. INTRODUCTION

This report by the U.S. Department of Agriculture is part of a comprehensive plan for development of the water and related-land resources in the Meramec River Basin in Missouri. The studies and reports by other Federal and State agencies are also expected to make their contribution to this comprehensive plan.

Included in this report are the analyses of current and future water-management needs affecting erosion control, flood prevention, water supply, fish and wildlife, and outdoor recreation. The relationship of agricultural water problems and the need for economic development was also appraised.

An inventory of the land resources for present and potential use is included. This report considers the immediate and projected needs for land and water resources and also the needs of food and fiber for the population within and surrounding the Basin.

The use of natural resources by agricultural and forest industries, and their contribution to the present and prospective economy, is included.

Authority

This study was made under the authority of Section 6 of the Watershed Protection and Flood Prevention Act of the 83rd Congress (Public Law 566, as amended) which authorized the Secretary of Agriculture to cooperate with other Federal, State, and local agencies in their investigations of watersheds, of rivers, and of other waterways to develop coordinated programs. It was carried out in cooperation with the U.S. Corps of Engineers, St. Louis District, and the State of Missouri.

Participants

The principal participants within the U.S. Department of Agriculture were the Soil Conservation Service, the Forest Service, and the Economic Research Service. This coordinated study within the Department is in accordance with the Memorandum of Understanding, dated February 2, 1956, between the Administrator of the Soil Conservation Service, the Administra-

tor of the Economic Research Service, and the Chief of the Forest Service.

Objectives

The purpose of this report is to contribute to a comprehensive plan for the coordinated development, management, and use of water and related-land resources of the Basin. The goal of this plan is to provide the highest level of benefits to the Basin, to the adjacent communities, and to the Nation.

It includes the following: (Exhibit 1)

A. An interrelated system of structures for water control and water-resource development and a pattern of related-land use and treatment whereby long-range-project needs are effectively satisfied.

B. Identification of the overall water management and control system, and land use required to satisfy immediate needs.

C. Identification of the elements in the plan which can be implemented by existing legislation.

The principal features of the USDA study include:

1. Appraisal and analyses of the present land use and treatment related to soils, erosion, and the use of land within its capability, including private and public forest lands.

2. Appraisal and analyses of the land-use development to satisfy future needs for agricultural and forest products; the identification of a land-use program that will develop and protect agricultural and forest lands so that each will contribute resources to assure maximum economic growth for the Basin, and the identification of problems related to flood-water and sediment damages.

3. Appraisal and analyses of the water management needs for irrigation, drainage, livestock, municipal and industrial water supplies, water-quality control, recreation, and fish and wildlife habitat improvement.

4. Appraisal and analyses of the economic impact of population on the needs of urban land, land for transportation systems, development of recreation facilities, employment and income opportunities.

5. Appraisal and analyses of the potential, design, and economic feasibility of an interrelated system of structures for water management which will provide for the immediate and long-range needs of the Basin.

II. DESCRIPTION OF BASIN

Location and Size

The Meramec River Basin is located on the northeastern flank of Missouri's Ozark Highlands. It is drained by the Meramec River, which heads in the Salem Plateau, and two tributaries--the Bourbeuse and the Big Rivers. The Meramec River is a tributary of the Mississippi River with the confluence about 11 miles south of the St. Louis city limits. The Basin, lying in a west, southwesterly direction from this confluence, has a longitudinal distance of approximately 115 miles and a maximum width of 80 miles.

The Basin with a total land area of 3,980 square miles or 2,547,200 acres includes all of Crawford and Washington counties and parts of Franklin, Dent, Jefferson, Phelps, St. Francois, Gasconade, St. Louis, Iron, Maries, Ste. Genevieve, Reynolds, Osage, and Texas counties. (Exhibit 2)

Climate

The climate is of the interior continental type with moisture-laden air originating in the Gulf of Mexico, hot, dry air coming from the desert southwest, and cold air masses from the arctic often prevailing in the winter. The temperature fluctuates over a wide range with the mean annual temperature of about 57° F.--extremes of -33° and +115° F. having been recorded. The mean temperatures are 33° for January and 78° for July.

The average annual rainfall for the Basin ranges from 35 to 42 inches. The average annual snowfall at the St. Louis station is about 16 inches. Most of the precipitation is in the form of rainfall, occurring in the spring months. Torrential rains in some years have been severe and have resulted in excessive runoff and flash floods during the spring periods. Sleet and ice storms occur almost every year. Tornadoes occur at irregular intervals causing extensive damage. Droughts occur almost annually during the late summer and early fall--severe droughts occurred in 1934 to 1936 and 1952 through 1954.

The average growing season is between 190 and 200 days. The average latest killing frost is April 5 in the counties bordering the Missouri River and April 10 for the south part of the area. The first killing frost is October 20 to 25 for the north part and October 10 to 20 for the south part. This reversal of expected north-south relationship is because of differences in elevation.

Topography

The topography ranges from broad ridges and gentle slopes to narrow ridges, steep slopes, and bluffs. The gently rolling topography is found in the north and west parts while the south-central area is steep to steeply rolling and is primarily in forest cover. There are about 1,500,000 acres of this land in capability class VII--stony silt loams and stony loams on steep slopes. The Clark National Forest boundaries cover approximately one-third of a million acres in this land class. Similar acreage in private ownership surrounds the National Forest. Few commercial family farms are found in this entire area.

Generally, the Basin is considered a "karst" area in which the topography is characterized by numerous "sinks" caused by solution channels in the limestone and dolomite formations. This process has produced large caverns, fissures, and channel ways in the rock formations. Sinks in the northern portion of the Basin are filled with refractory clays. In the southern part of the Basin, many caves and springs occur, especially along the main stream of the Meramec River.

The streams of the Basin are generally entrenched in steep valleys with narrow flood plains which vary from about one-fourth mile wide in the major tributaries to over one mile wide in the main stem of the lower Meramec. The elevations vary from 400 feet above mean sea level in the northeast to 1,400 feet in the southwest corner. The Basin is a highly dissected plateau, with rugged slopes in the south that become more gentle in the north.

The topography, soils, and land capabilities account for the major part of the Basin being forested. These features also account for the more highly developed agriculture in the northwest and southwest areas, with a smaller amount in the southeast area.

Geology and Soils

The Meramec Basin is underlain by rocks ranging from Pre-Cambrian through Pennsylvanian. The rocks, which crop out over a large portion of the Basin, are principally dolomites, cherty dolomites, sandstones, and limestones.

In the southeastern area, granites and felsites of Pre-Cambrian age are exposed. The Pre-Cambrian rocks are overlain by a sandstone, which in turn is overlain by massive dolomites and associated shaly dolomites. These strata from oldest to youngest are assigned to the Lamotte, Bonneterre, Davis, Derby-Doerun, Potosi, and Eminence formations of the upper Cambrian System.



WALKER--MISSOURI COMMERCE

Meramec Springs--largest of 31 recorded springs



Large natural stream winds through relative narrow valleys.

Below Valley Park, the Meramec River flows across geologically younger, cherty limestone and shaly limestone beds of the Mississippian System. In the eastern part of St. Louis County, these Mississippian beds of limestone are overlain by shales and thin limestones of the Desmoinesian Series in the Pennsylvanian System.

However, in the western part of St. Louis County and adjacent Jefferson County, outcrops of the St. Peter sandstone and the overlying dolomite and limestone beds of the middle and upper Ordovician are exposed. These strata are also seen in the bluffs which form the valley walls of the Meramec and the Big Rivers in the vicinity of Pacific, House Springs, and Eureka.

The northern part is underlain by younger formations made up of cherty dolomite and sandstone beds assigned to the Gasconade, Roubidoux, Jefferson City, and Cotter formations of the lower Ordovician System.

In the southwestern part of the Basin, the Meramec headwater tributaries are underlain by a thick, unconsolidated residuum that is the insoluble weathered remnants of the Roubidoux and Gasconade formations. The depth to solid bedrock varies from a few feet to 200 feet.

Shallow, cherty, or stony soils on rolling to steep slopes predominate, particularly in the south-central area. The northern, eastern, and western parts of the Basin include deeper soils, with a loessial soil varying from one foot to several feet in thickness covering the stony, residual, basal material which is of the Ordovician and Cambrian age. Roubidoux sandstone, Gasconade cherty dolomite, Eminence and Potosi cherty dolomite are the principal soil parent materials, modified by the loessial soil covering.

The south-central area, which has rough topography with shallow, stony soils, such as Clarksville and Fullerton, is largely devoted to the production of trees with some areas of open land around Salem and Belgrade. The loess-covered areas in the northern and eastern part of the Basin are generally deep and well drained and occur on rolling topography. Menfro and Union soils are characteristic of this area. The loess thins to the west and the slopes become more gentle with major ridges often almost level. Here the soils, such as Lebanon, are poorly drained and have limited effective root zone due to the presence of a "fragipan" layer in the subsoil. Steep slopes with rocky, shallow soils also occur in this area, especially adjacent to the streams.

The Basin is characterized by frequent small alluvial valleys, with widths varying from one mile, along the St. Louis-Jefferson County line, to less than 100 feet in the



Shallow, cherty soils predominate in the upland areas.

smaller drainage areas. The bottom-land soils in the broader valleys are generally deep, and well to moderately well drained, with Huntington soils predominating. These soils are very productive but subject to overflows. In the narrower valleys the soils are frequently gravelly in the subsoil and, in some places, on the surface. The bottom-land soils are very important to the farm unit since they produce most of the grain and roughage on the more prosperous farms.

The soil conditions combined with the physiography of the Basin result in four major hazards to agricultural production. The first, and probably the most common, is the droughty nature of the upland because of the presence of chert rock or gravel either in, or reasonably close to, the surface. The second is, the silty loessial soils on the more gently rolling topography have sheet and gully erosion primarily caused by the length of slopes and the incidence of tillage and overgrazing. The third is, the soils being low in organic matter and being of low base saturation, have moderate to low inherent fertility. Response to soil amendments is good, but moisture and soil depth limitations are a problem on most upland soils. The fourth hazard, one that frequently has the most spectacular effect on reduced production, is the flooding of stream valleys. Flash floods are common in the upper reaches, and inundation from standing water often occurs on the lower reaches.

Land Use

The Basin is divided into two National Land Resource Areas, the Central Mississippi Valley Wooded Slopes (115) and the Ozark Highland (116). (Exhibits 3 and 4) These resource areas have similar physical features and climatic environment. According to the U.S. Department of Agriculture's National Conservation Needs Inventory of 1959, land use is similar, but resource area 116 has a larger percentage of forest land. (Exhibits 5, 6, and 7)

Woodlands make up about three-fifths of the total area. In the southern part, up to 80 percent of the area is woodland. About 15 percent of the land, primarily in forest cover, is in public ownership: National Forests, State Forests, parks, recreational areas, and wildlife areas, covered with hardwood varieties of oak and hickory and occasional patches of short-leaf pine.



Hardwood forest is a major land use.

About one-fifth of the Basin area is cropland that is used in varying intensities. Row crops, small grains, and meadows are grown primarily on land capability classes I through IV.

The remaining one-fifth is in pasture and in other uses. The pasture land is used by the beef and dairy industries which produce approximately 70 percent of the agricultural income for the Basin. Most of this pasture is on land of capa-

bility class VI with smaller areas on classes III and IV. (Exhibit 8) Generally, the grass cover on these areas is adequate to prevent serious erosion and excessive runoff.

Agricultural land utilization in the Basin is as follows:

	<u>Percent</u>	<u>Acres</u>
Cropland	22	561,384
Pasture	14	363,154
Woodland	58.8	1,479,580
Other Misc.	5.2	143,082



WOOLDRIDGE--MISSOURI CONSERVATION COMMISSION

Agricultural development in the rolling areas.

More and more of the land in farms and forests is being diverted each year to meet the needs of a growing population for homes, highways, and institutions. In 1960 about five percent of the land was used for other than agriculture or forests. The land needs for urbanization have been expanding rapidly, and the continuing program of highway improvement requires additional land. Facilities serving these highways will eventually require more land.

Soil and physiographic features that limit agriculture also increase its adaptability to recreational and woodland

usage. Trees are well adapted, water impoundments are possible and the natural streams provide good recreational and wildlife potential in much of the area. The proximity of the Basin to the St. Louis metropolitan area provides an opportunity to develop its recreational potential.

Area in land-based and water-based recreation is approximately 40,000 acres. It is owned privately or by Federal, State, county, or city governments and about 60 percent is available to the public.



MASSIE--MISSOURI COMMERCE

Restored 19th century iron works at the Meramec Spring Park

III. ECONOMIC DEVELOPMENT AND ACTIVITY

Indians were the early inhabitants of the Basin, principally Shawnee, Delaware, Osage, and Kekapoo. They grew Indian corn and some root and vegetable crops. Indian corn was the principal crop of the permanent white settlers for many years after the Indians migrated to the West.

The counties in the Basin were organized between 1812 and 1857. The principal crops up until 1880 were Indian corn, oats, wheat, Irish potatoes, and tobacco. Grown in smaller amounts were buckwheat, rye, sweet potatoes, and orchard crops.

The first farming efforts of the early settlers were made with the rudest of implements. Up to 1815 in Jefferson County, two-wheeled carts, constructed entirely of wood, were used for hauling and were drawn by oxen. By 1850, horses, mules, and asses exceeded the number of oxen.

Livestock has always been a most important part of the Basin agriculture. The 1850 census recorded substantial numbers of horses, milch cows, other cattle, sheep, and swine. Livestock products, such as wool, butter and cheese, had become an important part of the farm income. During this period, the number of horses almost doubled, and other animals increased from 50 to 100 percent.

Agriculture was well developed by the end of the 19th century and, along with mining and forest products, constituted the principal industries early in the 20th century.

In the southern part of the Basin, much more attention was paid to mining than to agriculture. As early as 1712, lead was mined by French settlers northwest of Ste. Genevieve. Between 1800 and 1820, lead mining industries were established in Washington, St. Francois, and Jefferson counties.

Iron-ore deposits were also discovered and developed in the early 19th century. One of the earliest iron mills was the Meramec Iron Works established at Meramec Springs in 1829, which produced some of the finest iron in the entire country until the 1870's.

Since the early 19th century, timber has played a significant and continuing role in the development of the Basin. The predominant uses were for charcoal, buildings, railroads, and mines. Iron works used a large amount of timber for charcoal, while developing mines needed timbers. The railroads, with their expansion to the West, demanded a large supply of cross ties, many of which were provided from the hardwood timber of the Ozarks. Construction and growth of Midwest

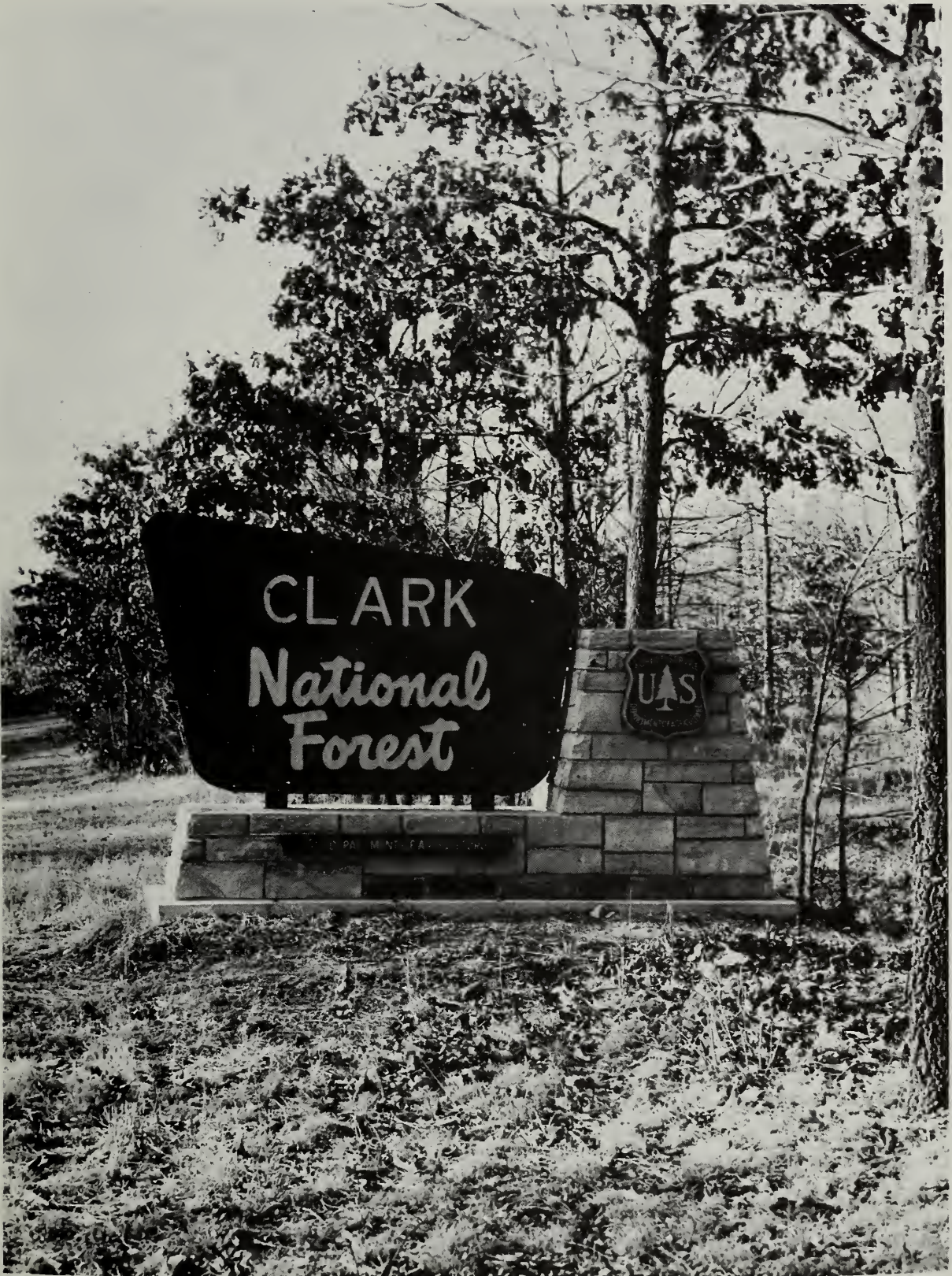
cities and towns were dependent upon the pine and hardwood timbers growing in great numbers over a large area in southern Missouri, including the Meramec River Basin. The stave, hub, and handle industries were developed. As a result, these various industries used most of the virgin hardwood forests by the late 1920's.



WOOLDRIDGE--MISSOURI CONSERVATION

Logging operations with limited resources

The forest conservation movement began in the early 1930's with the purchase of forest lands by the Federal Government for National Forests. Rebuilding the forest resources began, and conservation spread from this nucleus of managed forest land to the private landowners. Around 1940 the State initiated a forestry program. By 1950 the State and Federal programs were providing technical assistance in conservation forest management to private landowners. In addition, the U.S. Forest Service, Missouri Conservation Commission, and the rural fire departments worked with the people to decrease the size and number of fires in the forest.



FOREST SERVICE

One-sixth of the Meramec Basin is within the Clark
National Forest

Forest range, since settlement of the Basin in the 1880's, has been an important source of income to the people. In a recent range survey of the Clark National Forest, forage was found so severely depleted that further use would damage other forest resources. Thus, the remaining public range is being closed to grazing.

The Basin has always been popular with people seeking recreation. The areas near metropolitan St. Louis received the most intensive development. Before the automobile came into widespread use, the Missouri Pacific and Frisco Railroads scheduled special weekend trains to carry people into the Basin.

Although commercial recreational facilities of hotels and beaches were located near the river, the principal facilities were club houses. These were generally small cottages occupied by families or groups of friends. But several large St. Louis Corporations maintained facilities for their employees' recreational use at different points along the lower Meramec. Swimming, canoeing, fishing, and hunting were the popular types of recreational activities.



MASSIE--MISSOURI COMMERCE

Float fishing--popular on the major streams

With changes in income, more leisure time, and improved means of transportation, people now travel greater distances for their recreation. The building of new man-made reservoirs in other areas of Missouri and the adjoining States provides extensive areas of water for motor-boating, water-skiing, as well as fishing, and other water-based recreation. The people seeking water-based recreation generally prefer these reservoirs. Since the earlier recreational facilities--especially the commercial facilities--deteriorated, recreation was reduced in relative importance.

The middle and upper reaches of the Meramec appealed to a much smaller and perhaps harder segment of the population. Hunting, stream or float fishing, and "just being out" in the rugged wilds of the Ozark hills have provided rewarding outdoor experiences not found in the commercial developments downstream.

Population

Parts of the Basin are among the most sparsely populated sections in the eastern United States. About 210,000 persons live within the Basin. The area outside metropolitan St. Louis accounts for 140,000 persons, a density of less than 40 persons per square mile. In this area there are only 18 cities with a population of more than 1,000 (1960 census). Including the cities which make up a part of the St. Louis urbanized area, there are 30 cities with more than 1,000 population.

Rolla, with approximately 11,000 inhabitants, is the only one of the 18 upper Basin cities with a population greater than 5,000. The population of Flat River, when added to that of the cities which make up its contiguous urban area, is almost 10,000. Seven cities, totaling 15,000 inhabitants, comprise the Lead Belt in the southeastern section of the Basin. Six cities, comprising a total of 23,000 inhabitants, are located along an axis running from St. Louis to Rolla. All but Steelville are located on Highway 66 which follows the divide between the Bourbeuse and the upper Meramec drainage areas. Three cities in the 1,000 plus category, along with several smaller ones, are located along the Bourbeuse-Missouri River divide. Completing the list is Salem, in the southwestern part of the Basin, and Potosi, 15 miles west of the Lead Belt cities.

Six Meramec Basin counties, including all those near St. Louis, gained in population between 1950 and 1960. This contrasts sharply with the State trend for Missouri where population decreased in 88 counties and rose in only 26. Missouri counties that did not follow the general population decline were near a metropolitan area, a large reservoir, or an industrial or government installation. The construction

of reservoirs in the Basin, now or in the future, is expected to help arrest the decline and provide an impetus to growth. Total population changes by counties from 1950 to 1960 were as follows:

	<u>Percent</u>		<u>Percent</u>
Crawford	8.9+	Maries	1.9-
Dent	4.5-	Phelps	18.1+
Franklin	23.6+	Reynolds	25.4-
Gasconade	1.2-	St. Francois	3.5+
Iron	15.0-	St. Louis	73.1+
Jefferson	74.6+	Washington	2.3-

Of the 12 counties making up the major portion of the Basin, 9 had gains in their urban population. St. Louis County registered the highest urban increase in absolute numbers and Jefferson County the largest percentage gain. Urban gains in Crawford and Franklin counties were significant.

Several other county population characteristics, particularly the age structure, reflect proximity to St. Louis or characteristics of remote rural counties. St. Louis and Jefferson counties have the lowest percent of people age 65 or over. To a much lesser degree the same counties reflect their suburban character by having a higher percent under 18 years old. The reverse was true in most of the remaining counties which have a high percentage over age 65 as well as a high percentage under 18. These persons were generally outside the labor force and contribute to the low per capita income for their counties.

This age-population composition coincides with the low incomes and relatively depressed economy of the rural counties. It is both a cause and an effect, since larger proportions of the productive labor force have migrated out of these counties into St. Louis County. The change in median age between 1950 and 1960 accentuates the difference. The average age declined from 31.4 to 29.7 years in St. Louis County and 30.3 to 29.6 years in Jefferson County. Figures for towns and cities above 2,500 in these 12 counties indicate the same situation. Except for Phelps County on the western edge, these counties have the lowest average age. Phelps County, with the University of Missouri, Rolla and other government agencies at Rolla, is a special situation not duplicated elsewhere.

In the remote agriculture townships or the depressed Lead Belt mining area, the percentage of people over age 65 is 3 times that found in the suburbs. Intermediate age distribution patterns develop in Franklin County and agricultural areas of similar distance from St. Louis. Northern Washington County is an exception to this gradient pattern. This area has few farms and is sparsely populated. Most of the people

work at jobs in forestry and mining while others commute to jobs outside the area. The lack of people over age 65 may mean that very few farms or small towns have housing, medical or other facilities available for retired people.

Rural population in counties subject to urban influence has increased in the past 10 years. In counties that are strictly rural, there has been a decline in the population.

The total rural population is made up of approximately 75 percent rural non-farm and 25 percent farm. Much of the rural non-farm population consists of people moving out from the urban areas to live in the country. Jefferson County is an example of this exodus of people from urban to country living. Rural non-farm population in Jefferson County showed a twofold increase during the period 1950 to 1960. Rural population by counties in 1960 was as follows:

	<u>Non-farm</u>	<u>Farm</u>
Crawford	9,177	2,814
Dent	3,737	2,838
Franklin	16,447	7,273
Gasconade	6,292	3,368
Iron	6,647	1,394
Jefferson	45,960	3,914
Maries	4,219	3,062
Phelps	11,289	2,975
Reynolds	3,390	1,771
St. Francois	21,057	2,107
St. Louis	50,689	3,029
Washington	9,244	2,297

Many of the farm people are part-time farmers. They commute to urban jobs, small factories, mining, forest, and service jobs throughout the area. More than 50 percent of the farm operators have off-farm earnings that exceed their farm income. In the 1960 Census of Agriculture for Missouri, 74 percent were full owners, 18 percent part owners, and 8 percent managers and tenants.

The average farm operator is over 50 years old. Because of the high capital needed and the low farm income of the area, most young people migrate from the farm to work in metropolitan areas.

Employment

The Meramec River Basin has a diversified economy with a working force employed in many types of occupations. The northeastern portion of the Basin, including parts of St. Louis and Jefferson counties, is heavily populated. It is part

of the St. Louis Metropolitan Statistical Area. The working force engaged in agriculture comprises 2.6 percent in St. Louis County and 8.4 percent in Jefferson County. The remainder of the Basin is less heavily populated; its economy is based on services, manufacturing, agriculture, forest products, and mining. In the counties of Maries, Dent, Osage, and Gasconade, 35 percent of the workers are engaged in agriculture.

In the total Basin, approximately 12 percent of the work force is engaged in agriculture, leaving 88 percent engaged in nonagriculture employment. (Exhibit 9) Over 1,000 people are employed in forest-based industries. Employment of the work force is as follows:

	<u>Number</u>	<u>Percent</u>
Farm	7,100	12.0
Mining	3,100	5.0
Manufacturing	15,300	26.0
Services	31,600	52.0
Unemployed	<u>3,200</u>	<u>5.0</u>
Total labor force	60,300	100.0

Approximately 20 percent of the workers residing in the smaller towns and cities commute to their jobs, usually to the St. Louis metropolitan area. In the total Basin, only 8 percent of the workers commute to jobs in towns that are away from their residence. Approximately 10 percent of the small-town work force is unemployed; the Basin-average unemployment is only 5 percent. The farmers are also under-employed on their farms; 42 percent of the farm operators work 100 days or more off the farm.

Agricultural Production and Income

The largest acreages in cultivated crops are located along the northern border of the Basin and scattered throughout the Basin in the plateaus and alluvial valleys.

According to the 1960 census, the total value of all crop production was just under \$7.7 million. The acres in most principal crops have steadily decreased during the last 20 years, but the increase in yields resulted in a total production increase. Although soybeans, oats, and grain sorghum are grown, corn, wheat, and hay are the major crops produced.

Corn is the most important grain crop produced. Acres planted to corn reached a peak of 102,485 in 1944 and since then have gradually declined, reaching a low of 58,000 in 1961. With improved technology, yields have gradually increased from 32 bushels per acre in 1944 to 55 in 1961. The production of corn in 1960 was almost the same as in 1944 but



MASSIE--MISSOURI COMMERCE

Corn is the principal grain produced.

on 57 percent of the 1944 acres. Approximately 3.5 million bushels were produced in 1960.

Wheat is the second most important grain crop. Total acres have gradually declined by 50 percent while yields have more than doubled. Approximately 700 thousand bushels were produced in 1960.

The trend in oats planted has been irregularly downward. Acres harvested have declined drastically; yields have increased. Production was down to 275,000 bushels in 1960.

Soybeans is the only crop with acreage showing an upward trend. The yields have increased and also total production. Demand and prices have steadily increased for soybeans, and its production is expected to continue to increase. About 100,000 bushels were produced in 1960.

Acres of hay harvested since 1945 have remained relatively constant. While annual yield fluctuation is mostly a result of weather conditions, the long-term trend, because of improved technology, has been gradually upward. The production of hay, being second in value to corn, is important to the agriculture economy of the Basin. In 1960 approximately 125,000 tons of hay were produced.

Livestock is an important segment of the agriculture economy. Cattle, calves, hogs, pigs, and dairy products are the major sources of farm income. The value from the sale of livestock exceeds the value of crop production. The sale of livestock and livestock products as reported by the 1960 U.S. Census of Agriculture was approximately \$18 million.



Livestock and livestock products--the major source of agricultural income

Cattle and calves sold accounted for the major portion, with 70 thousand head marketed. The sale of hogs and pigs, with 145 thousand head, was second in importance. Sheep and lambs were third with 6 thousand head being marketed.

Sixty million pounds of whole milk were produced. The principal market is the St. Louis metropolitan area. Whole milk and butter contributed \$2.5 million to the farm income.

Chickens, eggs, and turkeys added \$2.4 million, with 1 million chickens and almost 4 million dozen eggs produced and sold. These products are also affected by the proximity to the St. Louis market.

The net farm income varies from \$668 per farm in Iron County to \$2,400 for Ste. Genevieve and \$2,100 for St. Louis and St. Francois counties. Many factors contribute to the variation of farm income. Some of the most important are soil productivity, farm size, quality, price per unit, and proximity of markets. Realized gross income and total net income per farm in 1959 were as follows:

	<u>Realized Gross</u>	<u>Total Net</u>
Crawford	\$4,076	\$1,318
Dent	3,692	1,360
Franklin	5,958	1,261
Gasconade	5,105	1,538
Iron	3,757	668
Jefferson	4,759	1,014
Maries	4,470	1,718
Osage	7,306	1,693
Phelps	5,627	1,263
Reynolds	3,347	1,290
St. Francois	5,657	2,100
Ste. Genevieve	7,050	2,413
St. Louis	9,843	2,176
Texas	3,922	1,506
Washington	3,552	1,042

Rural farm-median-family income averages about 80 percent of the median-family income for all families. Much of the family income comes from other than on-farm sources. Fifty-five percent of the farm operators in the Basin reported other income exceeding the value of farm products sold. Also, incomes of farmers and farm operators are approximately 40 percent of median income for all families.

Median Family Incomes - 1960 Census

County	Family	Rural Farm Family	Farmers and Farm Managers
(Dollars)			
Crawford	3,395	3,117	1,789
Dent	2,777	2,202	1,253
Franklin	4,863	3,883	1,443
Gasconade	3,906	2,615	1,147
Iron	3,305	2,836	-
Jefferson	5,767	4,591	2,077
Maries	2,891	2,566	1,468
Phelps	4,184	2,817	1,315
Reynolds	2,913	2,680	-
St. Francois	4,405	3,628	1,667
St. Louis	7,527	5,423	2,601
Washington	3,363	3,266	1,398

Total agricultural income is a significant part of the Basin economy. Although per farm incomes and rural farm median family incomes are below State and national averages, total farm sales exceed 26 million dollars annually. This does not include value of farm forestry products, value of home consumption, government payments, or rental value of home buildings.

Today, 93 wood-using industries are supplied totally or in part by the forested portion of the Basin. The primary manufacturers who engage in the initial conversion of a tree into the rough product produce over 30 million board feet of lumber per year.

Flooring mills, pallet producers, charcoal, and finished product manufacturers in the Basin purchase approximately 20 million board feet of rough lumber each year from the primary manufacturers. (Exhibit 10)



WOOLDRIDGE--MISSOURI. CONSERVATION

Wood using industries--an important source of income

The average annual payroll of the forest-based industries is \$2 million. Employees receive an average annual per capita salary of \$2,300. Annual average salaries of employees by forest-based industries in 1963 were as follows:

Rough lumber	\$2,360
Planed lumber	900
Flooring	2,590
Pallets	3,200
Finished products	3,060
Posts and poles	2,260
Mine props	1,600
Lump charcoal	2,040
Charcoal briquettes	2,860

The economic impact of the timber industry amounts to 12.3 million dollars per year. (Exhibit 11) Fifty-seven percent, or 7.1 million dollars, is attributed to the primary and secondary manufacturers in the Basin. The flooring industry is the leader with gross sales of 2.25 million dollars per year, followed closely by the charcoal industry with gross sales of 1.8 million dollars per year. In addition, land-owners are estimated to gross \$500,000 from sales of their timber. Contract log suppliers and haulers gross approximately \$961,000 per year by providing the primary processors with logs and other products. The growing, harvesting, and manufacturing of trees into wood products accounts for a gross return of over 8.6 million dollars in the Basin. An additional 3.7 million dollars is attributed to the transportation and marketing activities.

Related Income

In 1961 the total value of mineral resources mined in the Basin was 51 million dollars. This is about one-third of the total value of Missouri's mineral production. Mining industries employ over 50 percent of Missouri's mining labor force. Earnings of these workers are nearly \$20 million annually.

Since 1961 full scale production has started at the Meramec Mining Company's Pea Ridge iron mine and an additional shaft for lead mining at Viburnum by St. Joseph Lead Company. Both of these mines have large capacities and highly mechanized operations. The annual production value is not available for publication at this time.

Average income in the Basin outside the St. Louis suburbs is below both State and national levels. The lowest incomes are scattered throughout the Basin in areas of limited agriculture land and very little industry.



MASSIE--MISSOURI COMMERCE

Pea Ridge Iron-ore Mine and Pellet Plant--a multi-million dollar industry

Urban and non-farm incomes are only slightly higher than total rural farm income, reflecting, in part, the interrelated character of the economy of each county. In St. Francois, Washington, and Franklin counties, unemployment was over 6 percent in 1961.

Problems

A major problem in the Meramec River Basin is the underdevelopment of its natural resources. Water resources, in particular, have had very little development. Basin income lost because of this would be very difficult to determine, but it would certainly be quite significant. The development of the water resources would help alleviate many problems in the Basin, such as low income and unemployment.

The flow of the Meramec River is extremely variable--insufficient during dry summer periods and highly destructive at other times. During many periods, the streams in the Basin do not flow enough to provide recreation or favorable habitat for fish and wildlife. Water flow is often inadequate to dilute treated wastes in the lower Meramec.

Floodwater damage is also a major problem. An estimated 162,000 acres of bottom land, including areas of some towns, are subject to periodical flooding. Of this total, 85,000 acres are along the tributaries and 77,000 acres are along the main rivers. In the lower Meramec, the backwater from the Mississippi River affects 10,500 acres. The bottom land contributes all the grain and forage on many farms. Thus, floodwater damages to agricultural crops reduce, or sometimes eliminate entirely, the farm income and tend to depress the entire agricultural economy.



ST. LOUIS POST-DISPATCH

Tributary floods, a major problem to cropland--roads--public utilities

The lack of adequate recreation facilities, particularly water-oriented, is quite evident. Because of the Basin's proximity to the population center of metropolitan St. Louis with its large unsatisfied demand for recreation, there is a great opportunity for development of the Basin resources to help fulfill this demand. The opportunity to return so many recreation benefits per dollar cost, as exists in the Meramec River Basin, is unique. However, with the exception of some private lakes and minor developments along the natural streams, water-based recreation facilities are few in number.



Recreation cottages--early development along the larger streams

The lack of an improved transportation system for the entire Basin presents a problem which affects the full development of the mining, forest, and recreation resources.

Of the many problems associated with the agricultural economy of the Basin, unemployment, under-employment, and low farm income are the most outstanding.

Many farms are commercial family farms engaged in the growing of grain, hay, and pasture for livestock production, but other smaller, less economical-size farms are owned by people that obtain part of their income off the farm. These marginal units are a problem which also contributes to low income per farm.

The amount of investment capital needed to start farming or increase the size of unit to provide an adequate family income is a major barrier for young people desiring to farm. The lack of capital and low incomes result in a much slower adaptation of improved agriculture technology which, in itself, contributes to low incomes. Another problem is that the younger, more productive and better educated individuals are leaving the farm for outside employment.

The high cost of farm expenses and variable prices for livestock and grain sold has created a cost-price squeeze that tends to hold down net family income and consequently restricts the expansion of farm units and the agriculture economy in general.

Off-farm employment is both a benefit and cost to the farm economy. It allows many small operators to supplement their farm income. In many areas, pursuing off-farm income allows the operator little time to take advantage of modern technology or maintain his buildings and land. A general deterioration of the farm unit results. Buildings often lack attention, and the soil erodes. These problems and their solutions are being passed on to the future generation.

Alternative sources for farm income based on other uses of land in the Basin have not been fully exploited. The development of vacation farms, small lakes, hunting, and other recreation facilities on farms are alternatives.

With the rapid development of the area near St. Louis to residential use, many institutional problems are created. A prime factor in the expansion of these border counties is the urge of young couples to own their own homes. This demand increases the need for more schools, more roads, more local jobs, better police protection, and better health and welfare services. There becomes a problem of increased assessed valuation to provide the taxes to pay for these services before the property evaluation will justify the increase. Consequently, the ability to provide better fire protection, sewer and water systems, police protection, and classrooms lags behind the needs of the population.

This trend toward concentration of population has also created problems reflected in the pattern of land use. Subdivisions are being developed on productive, agricultural land in the flood plains while less productive land of the rolling hills is being left in timber and pasture. The lower costs of development of residential areas on these flood plains will certainly bring higher costs to society to provide flood protection. These areas of productive soils may also be needed in the future for food and fiber production for the rapidly increasing national population.

IV. RESOURCE USE AND DEVELOPMENT

Land

Soils having similar characteristics and lying within the same general climatic areas are grouped and combined into land capability classes for simplification in interpreting their potential uses. The Meramec River Basin has measurable amounts in six of the eight land capability classes of the U.S. Department of Agriculture. (Exhibit 13)

The distribution of land area by capability classes is as follows:

<u>Class</u>	<u>Acres</u>	<u>Percent</u>
I	63,828	3
II	121,938	4
III	436,757	17
IV	440,003	17
VI	494,878	20
VII	989,796	39
Total	2,547,200	100

The placement of soils in each class is determined largely by the nature of the soil properties, the steepness of the slope, and the amount of erosion resulting from past soil use. In the broadest sense, the capability class indicates (1) the types of use to which the soils are best suited and (2) the intensity level of management required to conserve the soil in the specific use.

Land in capability classes VI and VII is adapted to permanent cover such as forest and pasture. Land suitable for cultivation is in capability classes I, II, III, and IV.

Woodland comprises 59 percent of the area, cropland 22 percent, pasture 14 percent, and other land use 5 percent. (Exhibits 6 and 7) Of the present cropland, 19 percent has no particular problems, 9 percent has a wetness problem, 43 percent has erosion problems, and 29 percent is on steep, eroded land that is not suitable for cropland. The production on 85 percent of the pasture lands is low in relation to its potential under good management, but it usually has adequate cover to prevent erosion.

The land capabilities and soil types in the Basin were grouped in order to establish the distribution of the present crop production and to determine projected yields. The soil



FOREST SERVICE PHOTO

Forests--the major land use

groupings were made on the basis of production potentials. (Exhibit 12) The land use was determined for soil groups and correlated with Statistical Reporting Service and census data to normalize yields, acres, and production. (Exhibits 14, 15, 16, 17, and 18)

Because of the size of units, size of fields available for production, and level of technology used in the area, normalized yields for grain production in Land Resource Area 116 are slightly below those for Land Resource Area 115. (Exhibit 15) However, yields for hay and pasture are approximately the same for the two areas.

Since Land Resource Area 115 has higher yields and a larger portion of the cropland devoted to grain production, its normalized production of grain is greater than in Land Resource Area 116. (Exhibit 18) More cropland in Land Resource Area 116 is for pasture and hay with only enough grain to supply the livestock of the area.

Present normalized acres, yields, and production by crops are as follows:

	<u>Acres</u>	<u>Yield</u>	<u>Production</u>
Corn	77,000	47 bu.	3,619,000 bu.
Wheat	30,100	25 bu.	752,500 bu.
Oats	9,400	30 bu.	282,000 bu.
Soybeans	5,600	23 bu.	128,800 bu.
Sorghum	1,800	42 bu.	75,600 bu.
All Hay	112,000	1.5 tons	168,000 tons

Although it does not dominate the economy of the Basin, agriculture is a major source of income. (Exhibits 19 and 20) Its present and future status is important in economic planning for development of the resources in the region.

With the exception of St. Louis County, the productivity of the land in the Meramec Basin is below the State average. (Exhibit 21) St. Louis County ranks first in the Basin and 31st in the State. Reynolds County ranks the lowest in the Basin as well as in the State. Relative to other counties, 14 of the 15 counties rank in the lower one-third. Most of the upland in these counties is in timber and pasture, while crops are cultivated on the narrow alluvial valleys.



Bottom lands--important to the family farm

The total land in farms has declined 16 percent in 20 years. The rate of decline has been greater since 1954 than in the previous 15 years because of the increased use of land for urban developments and for highways. Total land in farms over the past 20 years was:

	<u>Acres</u>
1939	1,544,214
1944	1,515,169
1949	1,483,098
1954	1,444,199
1959	1,303,720

As the total land in farms declined, the number of farm units were declining at a 40 percent faster rate. Change in number of farms from 1939 to 1959 was:

	<u>Number</u>
1939	11,413
1944	10,371
1949	9,531
1954	8,544
1959	6,787

Much of this change is an attempt to create an economic unit by increasing the size of the farm. As a result the average size of farms has increased from 135 acres in 1939 to 192 acres in 1959. Change in average size of farms from 1939 to 1959 was:

	<u>Acres</u>
1939	135
1944	146
1949	150
1954	168
1959	192

This change has taken place at different rates for different size farms. The change for farms of 260 acres and over shows an increase in number, while those below 260 acres show a decrease. Since the overall number of farms has declined over the last 20 years, absolute numbers do not indicate the relative changes in farm size. Percentage computations reveal where the changes have occurred. The size of farms greater than 180 acres has increased in relation to those of less than 180 acres.

Technology contributed to the change in farm sizes. However, the major cause of consolidation of small units into larger commercial family farms has been the need for economic operating units--one of the most important is the utilization

of fixed assets, such as machinery, in order to spread the cost over more acres.

Number and Percentage of Farms by Size

Size of Farm (Acres)	1939		1949		1959	
	No.	Percent	No.	Percent	No.	Percent
1- 49	3,755	32.9	2,858	30.0	1,486	21.9
50- 99	2,329	20.4	1,830	19.2	1,215	17.9
100-179	2,841	24.9	2,335	24.5	1,656	24.4
180-259	1,232	10.8	1,182	12.4	991	14.6
260-499	993	8.7	991	10.4	998	14.7
500-999	217	1.9	267	2.8	360	5.3
1000-over	46	.4	68	.7	81	1.2
	11,413	100.0	9,531	100.0	6,787	100.0

The major reason that the change from small farms has not been greater is because of a large number of part-time and residential units. Since many of these operators have outside work, they leave the land idle or cultivate only a few acres.

The value of land and buildings per farm and per acre has increased significantly from 1939 to 1959 because of the large increase in capital investments, as well as an increase in the price of the land itself. Machinery and livestock are often valued in excess of the land on many farms. The average increase in value has been in excess of 300 percent since 1945.

The management level on farms is generally higher when land resources are available to provide an above-average income. Where land resources are not available, the farm operator often spends much of his time working away from the farm in order to make a living. The increase in farm business, the increase in average age of farm operators, and the increase of off-farm income affect the level of farm management and the number of farm operators and laborers. The increase in size of farm business and the decrease in number of operators result in increased income per farm unit. The increase in the average age of farm operators shows that the young people are not staying on the farm.

The increase in off-farm income indicates that some units do not produce enough income. When the income from a small farm does not support a family, it is easier to supplement the income with off-farm work than to increase the farm income. These factors often result in poor use of existing resources. Because of the operator's age or off-farm work, the woodlands,

pastures, and croplands are sometimes neglected. Cropland is often not planted or harvested; pastures and woodlands are usually neglected.

The timber on the 1,500,000 acres of forest land in the Basin is in a period of recovery. Volumes, stocking levels, species composition, and timber quality are at various stages of improvement, but the natural processes are slow.

In the forests of the Basin, 24 percent is sawtimber, 41 percent is pole timber, and 35 percent is reproduction stock and saplings. (Exhibit 22) Of these forest lands 20 percent, or 300,000 acres, has inadequate stocking of trees.

The sawtimber volume of trees, 12 inches diameter and greater, is 1.1 billion board feet. More than 6.6 million cords of wood are in trees less than 12 inches in diameter, while over 1.1 million cords of defective material are being produced that have no present or future value for timber products. (Exhibit 23)

Another indicator of forest conditions is the species composition of trees found in the stands. Hardwoods predominate. Black oak, white oak, short-leaf pine, and hickory are the species of value to forest industries. Eighty-seven percent of the sawtimber volume consists of the oak, hickory, and other hardwood species, while the softwood species of short-leaf pine and eastern red cedar are 8 percent of the sawtimber volume. Percentages of forest cover types were as follows:

	<u>Percent</u>
Good oak-hickory	51
Poor oak-hickory	30
Oak-pine	9
Cedar-hardwoods	6
Pine	1
Good mixed hardwoods	3
Poor mixed hardwoods	0
	<hr/>
All types	100

The Meramec Basin comprises about one-fourth of the eastern Ozark region where low tree quality is the characteristic feature of the forests. Only 47 percent of the trees are classified as crop trees, or trees which should remain in the stand for at least 10 years. The remaining 53 percent of the trees are considered a poor risk for the production of quality timber and should be removed from the stands. Almost 70 percent of the material in standing trees is classified as tie and timber grade. Another 22 percent is grade 3, while

only 8 percent of the saw material is in grades 1 and 2.
(Exhibit 23)

This presents a discouraging description of the quality of logs that the forest lands are capable of producing. (Exhibit 24) More than two-thirds of the sawtimber volume is too small to yield grade 1 logs or high-grade lumber, because the trees are in the 12- and 14-inch diameter classes. The carpenter worm and other wood borers cause much of the low quality and degradation found in the oak species.

Noteworthy progress has been made in the reduction of fires and the amount of forest land burned since the beginning of a fire control and prevention program in the Basin area. Fire prevention must be emphasized to offset the possibility of fires which could destroy the high value resources within the forest.

Continued grazing of private forest lands is one of the detrimental practices used today. However, more and more farmers are turning to improved pasture and hay meadows as a source of forage and are keeping the livestock out of their woodland.

The effects of forest management on wood production are evident. Approximately 15 percent of the forest land is managed by the Clark National Forest and the Missouri Conservation Commission. These lands contain 25 percent of the sawtimber volume and 26 percent of the growing stock volume.

Ownership of Timber Volume on Commercial Forest Lands

Ownership	Sawtimber		Growing Stock	
	Board Ft. (Million)	Percent	Cords (Thousands)	Percent
Federal	219.2	20	1461.5	22
State	52.2	5	263.3	4
Private	848.9	75	4939.5	74
All	1120.3	100	6664.3	100

Hydrologists have long recognized the characteristics of forests and forest soils to absorb water and retard water runoff during rainstorms. Forest cover, litter depths, humus types and land use are keys to the productivity of the forest watershed and its ability to improve in hydrologic condition.

The right-hand column of the following table shows that a very real opportunity exists for improving the overall hydrologic condition of forest land, since most of it is classified as in poor condition.

Hydrologic conditions of the forest floor under the various timber stands by size class are the following:

Resource Area	Size Class	Litter Depth		Humus Type		Present HC		
		Sat.	Unsat.	2	3	Good	Fair	Poor
- Percent Area -								
115	a	84.1	15.9	53.9	46.1	0.0	46.0	54.0
	b	81.5	18.5	28.4	71.6	0.0	71.6	28.4
	c	96.8	3.2	11.1	88.9	3.4	85.5	11.1
116	a	77.2	22.8	36.6	63.4	0.0	62.4	37.6
	b	73.2	26.8	41.2	58.8	0.0	58.7	41.3
	c	97.8	2.2	8.3	91.7	0.0	91.7	8.3

Road systems, power-line rights-of-way, strip-mining areas, industrial areas, and mining developments all contribute in varying degrees to the water-management problems on forest land. Road systems often contribute to sedimentation and excessive runoff. The long-standing practice of scraping ditch lines is a source of sediment.

Over 140,000 acres are being used for urban and residential, transportation, and recreation. Land in urban and residential use occupies over 57,000 acres.

Urban land by counties from the 1960 census was as follows:

	<u>Acres</u>		<u>Acres</u>
Crawford	3,500	Maries	600
Dent	2,500	Phelps	5,700
Franklin	7,400	Reynolds	-
Gasconade	700	St. Francois	4,800
Iron	400	St. Louis	19,900
Jefferson	7,900	Washington	4,000

Transportation systems cover approximately 17,000 acres; they include railroads, Federal highways, and primary and secondary roads. Strip-mine areas take another 11,000 acres while recreation is the primary use on about 40,000 acres. Many acres of the land in agriculture and forest are used less intensively for recreation.

Several large parcels of public land are scattered throughout the Basin and are administered primarily by the U.S. Forest Service, the Missouri Park Board, and the Missouri



Space for living--carved from rural lands.



MISSOURI HIGHWAY DEPARTMENT

For transporation--more and more agriculture and forest land

Conservation Commission. The Missouri Conservation Commission, the Missouri State Park Board, and St. Louis County have 36,500 acres in various tracts where recreational opportunities are available.

The Missouri Conservation Commission has four units of land that provide public recreation. These units are Huzzah Wildlife Area, Indian Trail State Forest and Refuge, Meramec State Forest, and Rockwoods Reservation. Timber, water, and wildlife are considered a part of the management objectives. Estimated attendance in 1964 was 13,000 at Huzzah Wildlife Area; 12,000 at Indian Trail State Park and Refuge; 30,000 at Meramec State Forest, and 200,000 at Rockwoods Reservation.

The Missouri State Park Board manages Washington and Meramec State Parks primarily for recreation. Hunting is not allowed, and limited timber is harvested. Both parks have a dining lodge, cabins, camping facilities, and are generally well developed for recreational purposes. The 1964 attendance totaled 276,000 at Washington State Park and 1,305,346 at Meramec State Park. The Park Board also owns the Edmund A. Babler State Park in St. Louis County. Attendance here in 1964 was 236,051.

Meramec Spring Park, another area open to the public, is operated by the James Foundation. It includes the largest spring in the Basin and has an area of 1,600 acres. During 1964 over 308,770 visitors were attracted; approximately 44,000 of these bought permits for trout fishing.

Meramec Caverns near Stanton and Onondaga Cave near Leasburg are privately owned businesses that provide sight-seeing tours through the caves as well as picnic and camping facilities. In 1964 attendance at Meramec Caverns was 514,000 and Onondaga Cave was 150,000.

St. Louis County provides several developed parks which had an estimated attendance of 1 million visitors in 1964.

Although the use of land for organized, land-based recreation is limited, on-farm hunting of small game and deer is enjoyed by many people. Woodland, in various combinations with pasture and cropland, provides food and cover for wildlife. Because of its game population and proximity to St. Louis these woodlands are heavily hunted. Most landowners do not charge fees for hunting, but some hunting clubs do acquire hunting rights to farm areas. Under such agreements, fees are paid to the farmers. The Clark National Forest is the largest public hunting area in the Basin and in the State.

Ownership of forested and recreational lands were as follows:

	<u>Acres</u>	<u>Acres</u>
Federal	191,174	
State & County	36,508	
Total Government		227,682
Farmers	615,139	
Other Private	636,759	
All Private		1,251,898
All Owners	1,479,580	1,479,580

Other recreation sites are those developed within the Clark National Forest. The Davisville camp and picnic ground on Huzzah Creek, where the clear water and high bluff in a forest setting offer many pleasant hours of relaxation, is the most popular. Other sites in the National Forest include a roadside park called Shirley Picnic Ground and the Hazel Creek area; the latter is primarily a picnic site used by local people. Visitors seeking the varied recreational and hunting opportunities available in the forested areas totaled 913,000 in 1964.

Additional recreation areas are owned and maintained by churches and other organizations, such as YMCA, Boy Scouts, and Washington University.

Water

On the farms, supplies of water for farm-household use and livestock are generally adequate. Water for the use of individual households is supplied by ground water generally from shallow wells tapping non-alluvial aquifers.

Water for livestock is obtained from wells, farm ponds, surface streams, springs, or some combination of these sources. In the upper Basin little difficulty is experienced in obtaining enough water by these means. Even under drought conditions, only the very shallow wells are affected. According to the Missouri Geological Survey and Water Resources, farmers are able to tap aquifers with enough capacity to insure year around supply.

Water from 31 large springs, numerous small springs, 130 small lakes, 1,996 ponds, and many miles of streams is available for use by farmers. Maramec Spring, located near the Upper Meramec River, is the largest spring in the Basin. It discharges an average flow of 96 million gallons per day. Annual flow records are not kept on most springs, but miscellaneous measurements are available on the large springs.

From the bulletin The Large Springs of Missouri, the minimum flow of the 31 springs is approximately 69 mgd. There are 27 springs that have an average discharge under 6 mgd, 3 springs discharge from 6 to 64 mgd, and 1 spring discharges from 65 to 225 mgd. This water is used by landowners for various purposes.

At the present time a small percent of the agricultural land is irrigated. Of 1,000 acres irrigated in 1960, 650 acres were in St. Louis County. Wells provide most of the water for irrigation.

Water for municipal and industrial uses is the principal demand on the water resources of the Meramec River Basin. In 1960 municipal and industrial demands, not including mining use, were approximately 5 million gallons per day (mgd) in the upper Basin and 10 mgd in the lower Basin. The 1960 per capita use varied from 52 to 139 gallons per day and averaged 70 gallons per capita per day (gpcd) in the upper and 110 gpcd in the lower Basin.

Most municipalities and water companies encounter little difficulty in obtaining the water needed. According to the Missouri Geological Survey, adequate supplies are available in most areas for the projected population and industrial expansion.

The cities of Eureka, Pacific, Valley Park, and Kirkwood have their own municipal water systems. The others, which are also contiguous parts of the St. Louis urbanized area, are supplied by the St. Louis County Water Company--a private corporation.

Eureka and Pacific depend upon ground water supplied from bedrock aquifers while Valley Park obtains its water from shallow wells near the Meramec River. Kirkwood obtains a major portion of its water supply from radial-type wells running beneath the bed of the Meramec River. A shortage from these wells required the building of a direct surface water intake in the river and the buying of water from the St. Louis County Water Company System. Plans are completed for a treatment plant having a capacity of 4.7 mgd and an expanded potential capacity of 10 mgd. Since the maximum capacity of the radial wells is 3.6 mgd, increased demands will probably be placed upon the river as a source of supply.

The St. Louis County Water Company obtains most of its water from the Missouri River; however, its South County Water Treatment Plant uses the Meramec River. During 1964 this plant reached a withdrawal rate of 21 mgd. The 1965 demand is expected to be 28 mgd. With the population growth

expecting to continue in Jefferson and St. Louis counties, the plant will soon reach its maximum capacity of 35 mgd and will require expansion.

Upper Basin municipalities utilize ground water as a source of supply, except for Union, which also uses water from the Bourbeuse River. Although Union has a new well of 600 gpm capacity, it is expected to continue using water from the river.

The Lead Belt cities buy their water from the Lead Belt Water Company--a subsidiary of St. Joseph Lead Company. This company utilizes ground water pumped from one well and from several mines.

Water for domestic use, where municipal water is not available, is supplied by wells tapping unconfined, non-alluvial aquifers. In the upper Basin, little difficulty is experienced in obtaining enough water by this means. In the lower Basin, where density of dwelling units is generally higher and the deep ground water is more highly mineralized, individual households are already having difficulty in obtaining satisfactory water.

At the present time, requirement for industrial water in the Basin is limited. Most of the manufacturing industries have relatively modest water requirements which are generally supplied by municipal water systems. No heavy water-using industries, such as oil refining, steel manufacturing, pulp and paper manufacturing, or steam-power plants, are located within the Basin. Mining is the major industrial water user. Their water requirements are obtained from surface and ground supplies and distributed by the mining companies' own systems. Sand and gravel operations are also important, but as with mining, most of the water withdrawn is returned to streams or ground-water basins.

Water-based recreation in the Basin is still an important resource use. (Exhibit 32) Of the 150 water-associated recreational areas, 12 are around spring developments, 67 around lakes, and 71 adjacent to streams. Several large springs were developed to provide trout fishing.

Many fishing and hunting clubs, sportsman clubs, and many organizations provide facilities for their members and employees along the rivers or on private lakes. Additional facilities are on private noncommercial developments which range in size from one acre to several hundred acres. In addition, the Bureau of Sport Fisheries and Wildlife reports that more than 1,300 miles of streams produce game and pan fish such as bluegills, rock bass, black bass, walleyes, and channel catfish.



Housing developed around private lakes--recreation at your doorstep.



Lake and recreation facilities--room for private developments

Many small lakes are located within less than two hours driving distance of St. Louis. According to an inventory of recreation units conducted by ERS and SCS in 1964, there are 130 of these lakes ranging in size from less than one acre to several hundred acres. The total water surface area is 1,761 acres. Water-associated recreational areas provide multiple use facilities for 2 to 12 activities, the average being 5.4. Fishing, swimming, and boating were the most popular activities furnished by these recreational units. There were 84 percent of the units furnishing facilities for fishing, 76 percent for swimming, and 47 percent for boating with small boats. The size and number of these lakes limit the types of activities available and the number of people that can be accommodated. Generally, public access is limited--the lakes being used only by surrounding property owners or by the group owning the recreational unit. Only 58 percent of the total water-associated recreational units in the area are open to the public, with 25 percent used privately, and 17 percent used for clubs and "members-only" groups. These small lakes, ponds, and recreation complexes have an estimated one million visitors per year.

The only extensive water-surface areas that are easily accessible to St. Louis are Alton Lake, about 20 miles north of the city, and the recently completed Carlyle Lake, about 60 miles east. Alton Lake is an impoundment formed by a navigation dam across the Mississippi. Its important advantage is being close to St. Louis. The estimated attendance at Alton Lake in 1962 was 2,761,000 visitors.

Most other large reservoirs are 100 to 250 miles from St. Louis which makes one-day round trips impractical.

V. NEEDS FOR RESOURCE DEVELOPMENT

Land

As a major resource used in almost all economic activities, land falls into five major categories: agriculture, forest, urban, recreation, and other.

The agricultural uses are cropland, grassland, and woodland. Farming is a complex business using knowledge of genetics, land and water management, conservation and soil treatment, combined with business-management ability.

Some of the resource problems are soil erosion, flood-water damage, sedimentation damage, and underdeveloped woodlands. To control erosion, maintain soil fertility, and make full use of their land resources, the farmers need to apply management and technical information recommended by local organizations and by State and Federal agencies.

Sustained agriculture in the Basin is dependent upon maintenance and improvement of the commercial family farm. The family farm is a business in which the operating family does most of the work and takes most of the risks. For a stable operation, a family farm must produce enough to pay expenses, including maintenance and interest on investment, enough to provide cash surplus for buying and maintaining the machines and goods needed, and enough to permit family living at an acceptable level.

Bottom lands average 7 percent of the total land area. Agriculture is competing for this alluvial land because it is the lifeline of the family farm. As more land shifts out of agriculture into urban, reservoir, roads, and other uses, the pressure increases to intensify the remaining bottom land for crop production.

A need exists to increase the size of the farm economic unit if an acceptable standard of living is to be achieved. Combining smaller units into larger units has been the trend in the past and is expected to continue. If crop production is to be increased, proper land treatment and flood protection are essential.

Increasing the size of the farm by adding more acres of cultivated bottom land has its limitations. Rarely can a farmer add bottom land without obtaining significant amounts of upland, most of which is unsuitable for crop production. The upland suitable for cultivation can only be farmed with



MASSIE--MISSOURI COMMERCE

Better farm units--require larger, improved family farms.

intensive land treatment measures for sustained agricultural production.

The more desirable approach to increased production is to make more efficient use of the acreage now available. Better crop rotations, adequate fertilizer, timely tillage operations, and more efficient water management are a few of the ways to increase production. Some of the woodland and brush on Class I and II bottom-land soils should be converted to cropland use. Soils unsuited for crop production should be managed for woodland, pasture, and recreational production. Without flood protection, farmers are reluctant to invest in land improvements that are subjected to flooding and erosion.

Farms generally located in the south-central portion of the Basin near the Clark National Forest are the least desirable for agriculture. The land is steep, mostly in woods, and has only a small amount of bottom land. Most of the flood plains are left in grass because they are narrow and the total cropland area of the farm is too small to justify the cost of machinery to cultivate them. The grassland is harvested through livestock and is often overgrazed.

These farms are generally managed by part-time farmers who obtain most of their income from off-farm employment such as mining and forest-related industries. Many of the farms are marginal units. The area is sparsely settled and has very few commercial family farms. The farm has become, in fact, a place of residence rather than a means of livelihood. Over 200,000 acres of these marginal units are in private woodlands and need intensive woodland management.

The demand for food by the population of the Basin (Exhibit 25), measured in terms of feed units, will reach 1,285 million units by 1980 and 2,273 million units by 2010. (Exhibit 26) The needs for agricultural products are determined from the national population projections and the expected per-capita utilization rates of agricultural products. Trends in per-capita utilization of meat, cereal, and dairy products are developed from studies made by the USDA.

The crop and pasture land used to its maximum potential for production would fulfill the needs of the Basin population until 1980. (Exhibits 27 and 28) This assumes that project installation, improved technology, improved management, and consequently increased yields will be attained. However, a physical potential for production does not indicate what will necessarily be attained. The rate of adaptation of technology, level of management, size of farm unit, alternate opportunity, interregional competition, and level of prices will determine

what farm operators will produce for the market in 1980 and 2010.

Present national trends indicate that fewer acres will be needed to fulfill the needs of the population of the United States until the 1975-80 period; but after 1980, an increase in acres is needed. This is also true for the Meramec River Basin. Because of its proximity to the market certain economic advantages will exist for the area. This may cause a future shift in the comparative advantage for agriculture in the area as compared to other regions. The Meramec River Basin is only one of many areas surrounding the metropolitan population of St. Louis, but it will surely be affected.

With this indicated increase in demand for farm products from the Basin, there is an anticipated need for a land-improvement program that will enable the agriculture resources of the Basin to meet this need. Flood-plain land is being used below capacity because of the high risk of flooding. It can help meet the demand if flood protection is provided. The gently rolling soils that are in grass and pasture may be converted to more intensive farming with the application of a complete land-and-water-management system. By the consolidation of small farms into larger economic units and by fuller mechanization, a more intensive type of agriculture is possible.

There will be rapid changes in the agricultural economy as the demand for food increases. A more productive use of the agriculture-resource base that will benefit both the farm operator and consumer can occur if the needs for bottom land flood protection and good land treatment are met. Proper agricultural water management will also enhance production. Provisions for future irrigation water is needed. Improvements in farming technology are expected to continue. The farm operator must maintain his land and its fertility to fully profit from these advances. Conservation treatments of lands are essential to maintain productivity of the family farm units.

Approximately one-half million acres of cropland is cultivated in the Basin. About 43 percent of the cropland, in capability classes II, III, and IV, is sloping and has an erosion problem. This land needs erosion-control practices to prevent deterioration.

Another 29 percent is classified as cropland that is either too steep or too eroded, or both, for cultivated crops. This land needs to be seeded to permanent vegetation with consideration for wildlife development.

Approximately 9 percent of the cropland has a wetness problem either from flooding or from lack of good drainage. Proper agriculture water management will enhance the productive potential of this land.

Almost all cropland, regardless of the problems, needs lime and fertilizers, the return of organic residues, and tillage practices to avoid breakdown of soil structure.

In the foreseeable future, about 300,000 acres of land will be in pasture. The USDA Conservation Needs Inventory shows that 54 percent of the pasture needs improvement of cover to control soil erosion and that less than 15 percent of the pasture land has received the treatment needed for good pasture. These facts indicate there is a need to improve both the forage quality and quantity.

The development of additional water supplies for livestock is needed for rotation grazing which is essential to good management and to the maintenance of an improved cover.

The condition of the land and the forests today is evidence of the speculative use that has occurred in the past. The continuance of this will lead to a resource which cannot accommodate the needs of today's population or its progenies. The need is for stewardship and rehabilitation of the forest.

We must recognize today's demands for use of the forest resources, as well as the growing demands for conversion of existing forest lands, for residences, highways, rights-of-way, and other non-timber uses. It will require private landowners to practice the multiple uses of their forest lands and to recognize the ability of their lands to adapt to the pressures made upon them.

A U.S. Department of Agriculture Forest Service publication of February 1965, Timber Trends in the United States, states that future crops of quality timber, especially hardwoods, will be in short supply and in continuing demand. Further findings are that the projected timber demands to the year 2010 could be met with more intensive forest management and utilization.

The need today is to rehabilitate the forest resource through proper forest management so that the future needs of industry and people can be partly met by the resources offered from the Basin. Never again should the pulp industry be discouraged from developing because of the scars of fires or because high grade harvesting has left only poor quality timber in the woods.

Cull-tree volume represents over a million cords of wood material. Its contribution to the worth of the forest is negligible and its removal is necessary so trees capable of growing good quality wood can replace them. This treatment is needed on 48 percent of the timber stands.



WOOLDRIDGE--MISSOURI CONSERVATION

Future forest production depends upon woodland improvement.

In the reproduction sapling stage, 60 percent of the young timber stands are composed of species that are of little value to the forest industry. These stands are usually referred to as the post oak and blackjack oak types. Conversion of this type to conifers or better hardwoods is necessary to increase timber production from these stands.

Fifty percent of the timber stands contain fewer trees than they are capable of supporting; as a result, the timber producing potential of the site is not being fully utilized. (Exhibit 24) These sites are in need of forest management to increase their productivity.

With an increase of resident populations, tourists, and sportsmen, the risk of starting forest fires will always be present. In addition, the build-up of burnable material on the forest floor will make fire prevention and control more difficult. Those responsible for protection to the surrounding forest need a staff equipped to meet the average fire conditions.

Insects and diseases are normal to some extent in a healthy forest. Much of the poor quality of standing trees is degraded even further by the ravages of insect populations. Effective methods of checking and controlling destructive insects, as well as the common forest diseases, are needed to insure high quality products to the forest industries. The forest condition is overall the poorest on those lands where cattle and hogs still graze. The need is to remove livestock from the forest.

Forest cover and litter influence water runoff and provide conditions for recharging underground water supplies. There is a general lack of information available on intensive treatment of the forest watershed by altering vegetation and treating forest soils to control and to regulate water movement. An increase in research is needed to determine the effects of intensive forest management to assure the best approach for meeting water demands.

With the population increasing rapidly, the need of rural land for urban and residential uses will increase. It is expected that the future urban land will increase fourfold. Urban planners, developers, and municipal or county officials need information regarding the advantages, limitations, and location of soils related to housing, recreation, road construction, and waste disposal. In addition they need sources of information on potential water supply, on recreation sites, and on standards for temporary erosion-control devices in construction areas.

The recreation land-use area, determined from the recreation inventory, includes only areas with some developed facilities. It does not include the large tracts of forest land which provide hunting, hiking, nature walks, and other outdoor activities for recreationists. Estimates based on recreation needs indicate that 100,000 acres will probably be needed for primary recreational use in the next 20 years.

The Basin shares in the national trend toward the growth of outdoor recreation. Visitors at the Meramec State Park doubled from 1962 to 1964. During the period from 1950 to 1960, the total recreation visitors to the Clark National Forest in the Meramec Basin increased over three times. This increase in use was made regardless of the limited public recreation sites and facilities that were available. In the Clark National Forest, the immediate need is for consideration of recreational developments to provide additional facilities.

There is a continually increasing pressure for additional forest recreation facilities on the public lands. The public agencies recognize the need to acquire key tracts of property within their authorization to plan immediate and long-range recreational facilities. The present appropriations are inadequate to meet the accelerated recreational demands on public land. Additional private recreational developments are also needed.

The increase of hunting pressures in the Basin has resulted in the closing of lands to public hunting. A need exists for private landowners to develop the wildlife on their lands through better management practices and then to lease harvesting rights to hunters.

Immediate attention needs to be given to wildlife food planting, semi-permanent brush piles, forest openings, field borders, and general improvement in vegetative cover on the entire Basin. An educational program to encourage the change in attitude toward better land management and wildlife conservation needs to be expanded. In order to increase and disperse game populations, the development of additional water holes on public and private ownership needs expanding. The public hunting areas in the Clark National Forest and Indian Trail State Forest and Refuge would benefit if certain key tracts now in private ownership were acquired for public management to increase the public hunting area.

Present methods of ore processing require waste areas and tailing ponds. These sites are normally used to capacity, then abandoned, leaving a barren area of sterile material which can support only limited plant life. To date, little

effort has been made to convert these areas to useful purposes. There is a need to determine what uses could be made of this type area.

Sizable areas of the Basin are strip-mined for barium sulfate rock commonly known as "tiff." Stripped-over areas are abandoned in a rough pitted condition with the top soil mixed with or covered by the subsoils of low fertility. Mineral rights for these abandoned areas are normally retained by the mining company since there is a possibility that re-working might become economically feasible. Meanwhile, the areas remain idle. These areas could be developed for recreational uses and wildlife habitats and could support a portion of the large recreation demand.

Water

In the United States the 1965 population per farm was 5.7 persons and the per capita water use was 9,100 gallons. Therefore, 51,870 gallons of water are needed per farm to fulfill the needs of the farm population. At the present time approximately 6,500 farms in the Basin have a total water use of 337,155,000 gallons annually.

This water need is being met from streams, springs, wells, and ponds which are able to furnish the quantity of water needed. However, on many farm units, a problem of location exists because many springs and wells are not located for optimum utilization. With multiple use of many fields, a source of water is needed in many locations on the farm, but this does not always occur. A present average of only one pond per farm indicates the continuing need for a vigorous farm pond construction program. At present, a program of technical assistance and partial cost payments for constructing farm ponds is available which should be continued and expanded.

An increasing need for municipal water from the Bourbeuse and the Meramec Rivers is expected at Union, Kirkwood, and the area served by South County Water Treatment Plant of the St. Louis County Water Company.

Over the past 20 years, many of the cultivated upland fields which produced heavy sediment loads in streams and rivers have been converted to pasture for livestock production. Although some sedimentation occurs throughout the Basin, sediment yield has diminished greatly. However, a need remains for application of land treatment and management practices to reduce sediment.

Other sources of pollution in agricultural areas are fertilizer, insecticides, and herbicides. Although the pollution of water from fertilizer, insecticides, and herbicides, without doubt, occurs in the streams, no study was made to determine its effect on water quality. Regardless, a need remains for checking and controlling the practices affecting water quality.

The most significant problems of water quality in the streams and rivers of the Basin generally occur in and near the St. Louis metropolitan area. In this area, provisions for quality control of the main rivers are included in plans of other agencies.

Congested housing developments around small recreation reservoirs are experiencing pollution of their lakes because provisions were not made to dispose of sewage. New developments are being built with similar inadequacies. This pollution of some small streams in urban areas needs corrective measures. Legislation is needed that would enable State and county health officials to prevent such unsafe practices.

There is an increasing amount of mining activity near Viburnum in the Upper Huzzah Watershed. Mine dewatering will increase the flow of two tributaries. Several lead mines, mills, and a smelter are operating, or are being proposed, above potential recreation sites. Slime ponds will be necessary below mine discharges and milling plants. Since the mining operations can pollute the sources of upstream water, protection of water quality is needed.

Present recreational facilities had over six-million visitors in 1964. Although water provided the setting for these facilities, most of the recreation activities were not directly associated with water. The most frequent water activities were fishing, swimming, and boating. Very few public recreational areas in the Basin have facilities for the popular water-based activities of boating and water skiing. The available water does not lend itself to this development. This recreational activity would have to be obtained outside the Basin in places like Alton Lake, Carlyle Reservoir, or Lake of the Ozarks.

Studies indicate that an expanding use of land for all types of recreational activity occurs when water becomes available for recreational use. With many acres of land suitable for picnicking, hiking, hunting, and nature walks being under-utilized, an opportunity exists to increase the recreational use of this land by providing additional surface waters. The result would be an increase in the use of both the land and water resources.

The estimates of recreation needs were based upon national procedures. These procedures assume that recreational development will not progress at a rate which will oversaturate the total demand as calculated.

In order to determine the needs of additional water-resource development and associated facilities for recreation in the Basin, an estimate of the recreation demand of the population was necessary. This estimate was essential to prevent overplanning of recreational facilities.

For recreational demand, the total population and its distribution throughout the area was determined. The population of the Basin, plus those within a 30-mile perimeter of the Basin, was included. (Exhibit 30) Since time, distance, and transportation systems are important factors influencing recreationists, the time zone map from the Meramec Basin Research Project was used. This reflects distance and time for travel from St. Louis to various parts of the Basin. (Exhibit 29)

Present and projected population and its distribution by time zones are as follows:

Time Zone	1960	1980	2010
	(thousands)	(thousands)	(thousands)
1 hour	1,743.4	2,214.0	2,916.4
1 to 1½ hours	67.1	161.5	307.1
1½ to 2 hours	83.1	113.3	160.8
2 to 3 hours	45.8	64.6	94.1
Total Basin	1,939.4	2,553.4	3,478.4

The next step in estimating recreation demand was to determine the percentage of the population and the number of days per year they would participate in various activities. The standards used were similar to those in the ORRRC reports.

Recreation demand by number of recreation days for each time zone in 1960 was as follows:

	<u>Recreation Days</u>
1 hour	10,065,868
1 to 1½ hours	387,415
1½ to 2 hours	479,791
2+ hours	264,435
Total Basin	11,197,509

Although these estimates are subject to some degree of error, they provide general approximations of the total needs of the population for recreation facilities. (Exhibit 31) The 1960 demand of 11 million recreation days was not satisfied; the existing facilities provide only an estimated 6 million recreation days. Thus, a deficit of approximately 5 million recreation days existed in 1960. The projected population and rates of usage provide estimates of future demands. The increase in population and in rates of recreation participation are expected to increase the demand for recreation. Therefore, the failure to develop the water resources of the Basin will result in larger deficits in the future.

Most of this deficit is in water-oriented activities. Water-oriented recreation on public and private lands is the subject of increasing interest throughout the Basin. The Clark National Forest and the lands managed by agencies of the State of Missouri cannot meet immediate or projected demands with the present streams and reservoirs. Unless large areas of surface waters are made available for public use, most of this demand will remain unsatisfied.

Preferences of people indicate a desire for many different types of activities in and around recreation reservoirs. Fishing, swimming, boating, picnicking, and camping are usually the most popular. Clean, well-constructed facilities, with activities zoned to specific areas, should increase the recreation-carrying capacity of sites and enhance their recreational values.

There is a need on the public forest lands for reservoirs with fully developed recreational facilities to satisfy immediate demands and fully develop the recreational potential of the area.

The streams generally provide good fishing. The Meramec, the Big, and the Bourbeuse Rivers provide float fishing. The fish population of the streams is maintained by natural propagation. In two limited areas, trout fisheries are maintained and stocked by the State Conservation Commission. Better public access to streams and rivers is needed.

Most of the many small lakes and ponds were initially stocked with fish by the Missouri Conservation Commission. Through natural propagation and uneven harvesting, the population of these ponds often becomes unbalanced. More and better-managed lakes and ponds are needed to meet the fishing demand.

The Missouri and the Mississippi River flyways, on the north and east sides of the Basin, are used by most of the migrating waterfowl. Since few birds use the water facilities

in the Basin, hunting of waterfowl is not an important sport. But rest areas for migratory waterfowl can be established on reservoirs by restricting hunting and boating during autumn. Little opportunity exists for developing major waterfowl refuges, nor is there a need according to the Missouri Conservation Commission.

An economic evaluation was made to determine the potential for supplemental irrigation of the field crops presently grown on the bottom lands. Although it revealed that irrigation would be a "break-even" proposition at this time, individuals often do not consider irrigation until after the water supply is available. A water-resource-development program should have flexibility so irrigation water will be available for the irrigation expansion that is expected.

Reconnaissance examinations of flood plains with detailed studies of typical tributaries revealed that flood protection of the bottom lands is a primary water-resource-development need of the Basin. Floods reduce yields by direct damage to crops and also cause delays in spring planting and replanting. Flooding, and the danger of flood damage, affects the optimum land use and prevents development of bottom lands.

Many acres of low bottom lands are subject to several floods each year. Normally, these acres are the most fertile lands of the valley, but they are generally used as unimproved pasture and woodlots. The flooding and land-use conditions are often critical in the tributary valleys. On these bottom lands, the crops and forage that are produced are utilized along with hill-land pastures to support livestock.

Crop failures, or limited yields resulting from flooding, place the livestock producer in an untenable position. Optimum production from the fertile valley croplands is needed to maintain and to strengthen these family-farm units. Flood-water-retarding structures and minor channel snagging and clearing are needed to alleviate the frequent bottom land overflows.

About 50,000 acres of cropland have a wetness problem. Although this amounts to only about 9 percent of the present cropland, the wetness problem appears more acute when you consider it affects 30 percent of the total bottom lands. These problem areas are identified by imperfectly drained, or poorly drained, nearly level to undulating soils of the bottom lands. These soils are subject to stream overflow and surface ponding from water that has accumulated from side-hill drainage. Diversion terraces are needed to intercept runoff from adjacent hills and convey the water by surface ditches to natural outlets. Surface field ditches, with some land smoothing and grading, is needed to remove excessive

runoff. In most cases, the flood plains are narrow enough to outlet surface ditches into natural streams without using main laterals or floodways. Some ditches will require grade stabilization measures to prevent gully erosion.

VI. PROJECTIONS OF RESOURCE USE AND ECONOMIC DEVELOPMENT

Land Use and Management

Improved technology and its rate of acceptance and adaptation by farmers are the major factors contributing to increased agricultural production. These technologies are primarily improved plant breeding, better methods of weed and insect control, application of soil and water conservation practices, and increased managerial techniques. Through land and water resource development, the implementation of the proposed USDA plan will have an additional effect on agriculture production.

In making projections, average weather conditions, as well as average prices for both inputs and outputs of the production process, were assumed. Implicit in these relationships is that national crises will not occur and a high level of employment and personal income will continue.

There will be a continued decrease in the number of farms. Those remaining will be larger and better managed as a result of improved methods of market news distribution and new farming techniques that will be more readily accepted.

Mechanization of farm operations will allow a higher percentage of planted acreages to be harvested with a minimum of loss. Therefore, both yields and total production will increase.

Rates of change for number and size of farms from 1960 to 1980 will be considerably less than 1940 to 1960. Actual farms for agriculture production will continue to change and become larger units. However, they will be offset by the large number of farms being divided into smaller units in the area surrounding St. Louis. These smaller units may still be classified as farms according to census criteria, but will actually be suburban homes with acreages. This will, of course, affect the distribution of the size of farms throughout the Basin. The farms in the outer regions and the Bourbeuse River sub-basin will continue to increase in size and decrease in number, and those near the urban centers will decrease in size and increase in number. The result will be a leveling out in the rate of change now taking place. The projections for 1980 are:

Land in farms	1.2 million acres
Average size farm	230 acres
Number of farms	5,200

Also, there will be a change in the farm population. Fewer farmers will be engaged 100 percent in farming, and more people will work at off-farm employment. As a result, the populations of the rural and urban areas will become more alike in the future than in the past.

The trends since 1945 for each major crop were analyzed. Straight-line extrapolations were computed for 1980. Projections of changes on a regional basis were studied and adjustments of the Basin projections were made using them as guide lines. This tends to reflect the comparative advantages existing between the Meramec River Basin and the surrounding regions.

Costs of production were studied and some changes in crops by soil productivity groups were made. In these cases, assumptions were made that production of some crops on certain soils would not be economical because of increasing costs. Therefore, some soils in the lower productivity groups would shift from row crop to meadow or pasture.

Alternate opportunities of farm operators were considered. With increased industrialization, the opportunities for off-farm employment are increasing, causing farmers to shift from an intensive to extensive type of enterprise.

The installation of the flood-control measures and consequent reduction of flood damages will bring about an increase in yields and total production. (Exhibits 33 and 34)

The projected harvested acres, yield, and production of major crops without the project for 1980 are the following:

Crop	Harvested	Unit	Yield	Production
	(acres)			(thousands)
Corn	66,000	bu.	71.7	4,370.0
Wheat	29,000	bu.	35.5	1,030.0
Oats	5,000	bu.	42.4	212.0
Soybeans	12,700	bu.	31.9	405.0
Sorghum	2,700	bu.	57.8	156.0
All hay	98,000	ton	2.03	199.1

In future years, development of land and water resources will parallel technological advances in maintaining agricultural production. Considering changed land use and increased yields from technological advances, including conservation measures, indications are that agricultural production of crops will increase. Complete tables for each crop--its projected acreage, yield, and production by each Land Resource Area and Basin total--are found in Exhibits 33, 34, and 35.

Projected harvested acres, yield, and production with project installation for 2010 follows:

	Harvested	Unit	Yield	Production
	(acres)			(thousands)
Corn	78,000	bu.	98.8	7,706.4
Wheat	31,000	bu.	56.1	1,739.1
Oats	5,000	bu.	53.5	267.4
Soybeans	19,000	bu.	46.9	891.0
Sorghum	5,400	bu.	70.5	381.0
Hay	112,000	ton	3.67	410.8

The projected cropland will produce the feed units required for the livestock to supply needs of the population in 1980. (Exhibit 27) Feed units produced with project implementation are 1,274.6 million; feed units needed are 1,285.8 million. Therefore, if the proposed plans were implemented, the level of agricultural activity could be increased to meet the food and fiber requirements of the expanding population for 1980.

The results of analyzing the situation for year 2010 are quite different. (Exhibit 35) The production of feed units are projected to be only 1,715.9 million units, and the needs of the population are 2,273.42 million units. The deficit amounts to approximately 25 percent of the needs. The deficit without the project for both 1980 and 2010 indicates a definite need existing for a complete program of land and water resource development in the Meramec River Basin.

Estimated Need for Livestock and Livestock Products

Commodity	Unit	1980	2010
		(million)	(million)
Meat animals <u>1/</u>			
beef and veal	lb.	75.3	125.8
lamb and mutton	lb.	2.7	4.5
pork	lb.	38.1	62.3
Dairy products			
milk equivalent	lb.	227.6	368.5
Poultry <u>1/</u>			
chicken	lb.	18.1	31.9
turkey	lb.	5.4	8.8
eggs	number	120.4	196.2

1/ Liveweight basis

Population pressures will cause shifts in major land use to meet the emerging demands for land, many of which will have priority over agricultural use.

Estimated Present and Future Land Use

	Present	1980	2010
	(acres)	(acres)	(acres)
Cropland	561,384	524,324	490,000
Pasture	363,154	305,504	300,000
Woodland	1,479,580	1,417,910 <u>1/</u>	1,259,608 <u>2/</u>
Other	143,080	299,460	497,590
Total	2,547,198	2,547,198	2,547,198

1/ Includes 50,270 acres of recreation land with woodland cover which is around proposed reservoir developments.

2/ Includes 92,900 acres of recreation land with woodland cover which is around proposed reservoir developments.

The condition of most forest lands must be improved to meet the future demands. The bulk of the responsibility will lie with the private landowners. Projections of the timber resource, its volume and condition to the year 2010 have various aspects of speculation and conjecture. Over the next 50 years a number of factors could influence the timber resource. An immediate program of timber-stand improvement to rehabilitate the forests would significantly affect its future production and condition. New technology would affect the volume produced while an influx of forest industry using wood pulp and fiber would also affect these projections. A change in the public's acceptance of substitute products for the commonly accepted forest products would certainly influence forest-management activity.

Timber volume will increase from an average of 3,000 board feet per acre today to 6,040 board feet per acre by the year 2010. This projection considers that current growth and harvest rates will not change, that present management levels are maintained, and that private owners will continue to accept management programs at the same rate as in the past. The capacity of the average timber-growing sites can support the growth, since 80 percent of the land has a site index equal to or better than the average. By 2010, about 53 percent of this volume, or 3,230 board feet per acre, will be in growing stock or cord wood. The majority of stands will not be of harvest age.

There will be some changes in the distribution of species. Short-leaf pine which currently occupies 1 percent of the forested area will occupy approximately 8 percent of the forestland area by the year 2010. Much of the reproduction under present over-story stands on this area is pine. The natural

conversion will reduce the present oak-pine type by about 55,000 acres, leaving, roughly, 6 percent of the forest area in oak-pine type. The present oak-hickory type will contribute to the pine acreage. The oak-hickory stands, which are presently in good condition and occupying suitable sites, are expected to comprise about 54 percent of the forest area, while the poorer oak-hickory types will occupy 23 percent of the forest area by the year 2010. There will be little change in the mixed hardwoods and cedar hardwoods.

Increased interest in forest management is expected and will result in generally better quality wood material produced by the year 2010. It is further expected that the lands of the Clark National Forest will be producing the highest quality and quantity timber available because of past fire protection and forest management.

The quantity of timber and the productivity of the forests indicate a good future for forest industry. Hardwood flooring, pallets, and construction lumber will be increasing in demand on the national market through the year 2010. Charcoal, post and pole, and railroad-products industries will enjoy a steady national market. The stave and cooperage markets are expected to continue with erratic periods of activity. A demand for hardwood pulp is increasing and expecting to comprise 40 percent of the national demand for pulpwood.

Lumber production is expected to increase 50 percent by 2010. The productivity of industrial mills will increase and utilization of sawlog material will be better. There will be few part-time operations left in the lumber industry. Most of those that remain will have portable equipment that can move into smaller tracts and profit on smaller per acre harvests. They will be of considerable value to the small woodland owner with properties under management and in need of intermediate timber harvest. In areas outside their central plants, the larger lumber producers will be using portable mills for cutting cants which will be hauled to the central plant for processing.

The development of forest industry in the future will require considerable capital investment. The interest and action of forest-land managers in improvement of their properties can very well be the catalyst for forest-industry development in the Meramec River Basin.

Projecting the trends to 1980 and 2010, land needed primarily for recreation is 75 thousand acres in 1980 and 150 thousand acres in 2010. This is a conservative estimate that can easily be exceeded. Many other areas will certainly be

subjected to occasional use at various seasons of the year, but most of these areas will be the multiple use of forest lands and related areas.

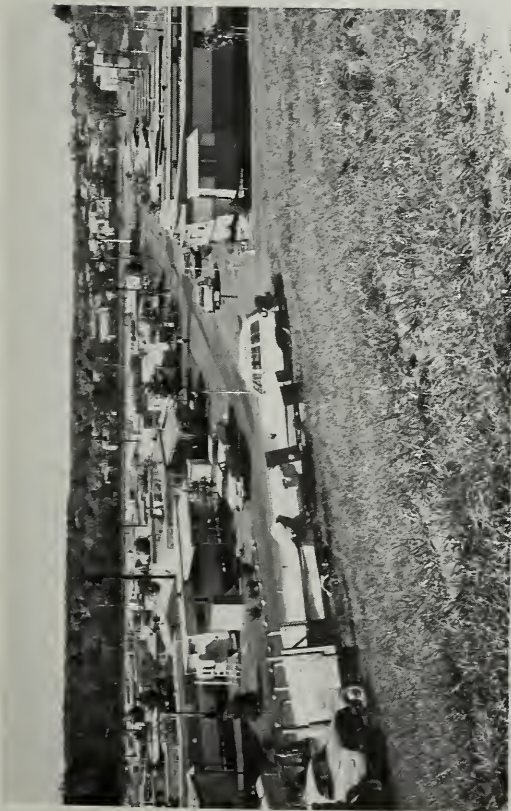
Hunting pressure is expected to increase on all lands. The demands made on wildlife and on its habitat by man during the next 50 years may be greater than those made on any other single resource. This demand--reducing the natural habitat area and increasing the number of hunters--may easily destroy the ability of the natural habitat to provide food and shelter for wildlife. Thus, game and the needs of the people would become "out of balance." Rural areas can realize a significant economic advantage by maintaining wildlife populations. Hunter-days are expected to double by 1980 and then double again by 2010. Private landowners will be increasingly successful in attracting sportsmen. This will be particularly true of those who can provide room and board, as well as good game populations for the hunter. Individuals or groups of sportsmen will own or lease large forest acreages specifically for their hunting enjoyment.

Other land-based activities such as hiking, riding, camping, picnicking, and general sight-seeing will continue to increase rapidly on public as well as private lands.

Even without added impetus the number of commercial on-farm recreation enterprises will increase slowly, since many present owners are not interested in this type development of their lands. Because persons dealing with the public require special characteristics of organization, attitude, tact, and service, few of the present landowners will successfully operate this type enterprise. Development of individual projects will continue on a trial-and-error basis. An occasional successful operation will emerge while many others will fail because of inadequate resources, technical guidance, or management.

Population trends since 1920 and projections of Basin population for the year 1980 and 2010 have been made for whole counties, for portions of the counties, and for towns and localities.

The estimated predictions for 1980 call for a total population of from 340,000 to 490,000, a twofold increase over 1960. The Basin portions of St. Louis and Jefferson counties will increase from 190,000 to 310,000 and the remainder of the Basin from 150,000 to 180,000. For the year 2010, the estimates are about 765,000 to 950,000 for the whole Basin, from 550,000 to 650,000 for Basin portions of St. Louis and Jefferson counties and from 215,000 to 300,000 for the remainder of the Basin.



Increasing population will demand more land for
housing--education--industry--business



Future Population Adjusted for Location Factors
and Development of the Basin

County	1960	1980		2010	
		Adj. Median	Adj. High	Adj. Median	Adj. High
- Thousands -					
Crawford	12.5	18.5	23.8	27.5	40.5
Dent	9.0	10.6	15.3	14.2	25.2
Franklin	26.0	42.5	51.5	77.4	99.5
Gasconade	2.5	2.6	3.3	3.5	6.6
Iron	1.5	1.8	2.7	5.5	8.5
Jefferson	28.0	78.8	197.5	250.0	300.0
Maries	2.0	1.9	2.4	2.2	3.2
Phelps	20.0	26.0	29.6	37.5	44.0
Reynolds	0.1	0.1	0.1	0.1	2.3
St. Francois	25.0	24.2	25.9	26.0	28.0
St. Louis	60-80	115.0	115.0	300.0	350.0
Washington	14.1	17.2	22.1	21.6	34.1
Total	220.7	339.2	489.2	765.0	941.9

The Estimated Urban and Residential Use of Land

County	1960	1980	2010 w/project
	(acres)	(acres)	(acres)
Crawford	3,500	6,000	11,500
Dent	2,500	3,700	7,100
Franklin	7,400	13,300	28,200
Gasconade	700	800	1,900
Iron	400	600	2,400
Jefferson	7,900	39,200	85,000
Maries	600	600	900
Phelps	5,700	7,900	12,500
Reynolds	-	-	600
St. Francois	4,900	7,100	7,900
St. Louis	19,900	32,600	99,200
Washington	4,000	5,500	9,700
Total	57,400	117,300	266,900

Population growths, changes in technology, and planned developments in the Meramec Basin will reduce the amount of land available for an expanded agriculture. Also, reservoir construction, city expansion, and urban sprawl may require

nearly 200,000 acres to meet other basic public needs within the next 50 years.

Water

The present sources of water for agricultural use are adequate to meet the projected needs for 1980 and 2010. Additional water for livestock will be beneficial to the grazing program expected from increased livestock numbers.

Municipal and industrial water for the upper part of the Basin is supplied entirely from ground water. The projected demands are expected to be 32 million gallons per day by 1970 and 54 million gallons per day by 2020. According to the Missouri Geological Survey, the present use of ground water is approximately 24 million gallons per day and the withdrawal of ground water may be increased to 500 million gallons without depletion of the aquifers. Therefore, future demand in the upper Basin is expected to be met without additional surface storage.

The Missouri Division of Health estimates the municipal and industrial water intake from the Meramec by the Kirkwood and South County Treatment Plants would reach 34 mgd in 1965. According to the U.S. Department of Health, Education and Welfare, municipal and industrial water demands of the lower Meramec are expected to reach 93 million gallons per day in the next 60 years. Water from the Meramec, the Missouri, and the Mississippi Rivers and ground water now supply present demand. Using all the ground water sources in the area, a demand of 25 mgd can be supplied.

The demand for water in the rapidly expanding areas of St. Louis and Jefferson counties will continue to increase. As it increases, the area will become more dependent upon surface water from the Meramec River. This assumes that water from the Meramec River can be pumped and processed more economically than from wells or from the Missouri or the Mississippi Rivers.

The most basic factor affecting recreation demand in the future will be the number of people. If economic conditions continue as anticipated, or if we are not involved in a national crisis, the population for the United States will virtually double in less than 50 years. Population will increase from 180 million today to approximately 254 million by 1980 and to 424 million by the year 2010. The population trend for the evaluated area--the Meramec Basin plus the area determined by moving the Basin perimeter 30 miles beyond its boundary--will follow approximately that of the nation. This (Basin plus 30 miles) population is projected to rise from 1.9 million

in 1960 to 2.55 million in 1980 and 3.5 million in 2010. Projected population increases represent a doubling of recreation demand even if the participation rates did not increase.

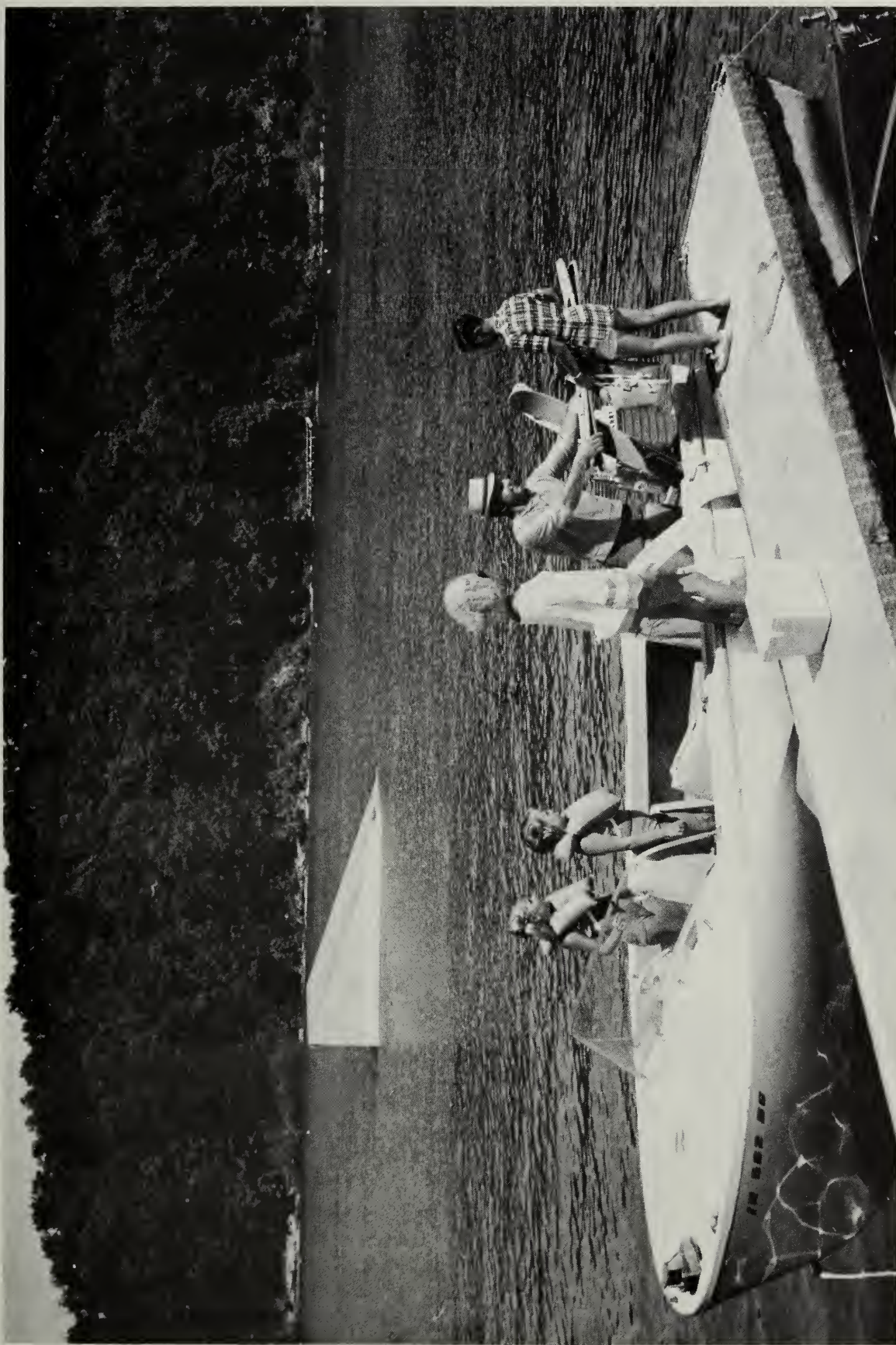
The population will be concentrated in the metropolitan areas. In composition, it will consist of more young people who are the most active recreationists. Because of the expected increase in the adult educational level, the occupational composition will shift with more people going into the professional and white-collar categories.

In the ORRRC study, a large number of people reported that lack of time and lack of money prevented them from engaging in more outdoor recreational activities.

Less time will be spent at work and more time available for recreation. By 1980 the standard scheduled work week will average 36 hours for the entire industrial work force. By 2010 it may average as low as 32 hours. Along with the shorter work week incomes will be higher. This new affluence will allow people to participate in the activities that they enjoy. An increased demand per capita for recreation facilities is anticipated. Therefore, future recreational demand will be affected not only by increasing population but also by higher per capita participation rates resulting from higher incomes and shorter work weeks.

The forecast of travel suggests an enormous expansion. By 1980 the projected number of passenger cars in the United States is estimated at 100 million. The new degree of mobility will increase the pressure on recreation sites now available. The most remote part of the Basin is only $2\frac{1}{2}$ to 3 hours travel time from St. Louis. The time will become less in future years as transportation systems are improved and expanded. As a result, there will be a tremendous need for development of the water resources in the Basin to satisfy the recreation demands of the population. The available supply of recreation facilities is another factor that tends to stimulate demand. The opportunity to try a new activity is often a necessary stimulus that, once experienced, can set off a spiral in demand that is almost impossible to estimate. (Exhibits 36 and 37) However, using the data available, estimates of the projected recreation demand for the Basin population have been computed.

An analysis of the estimates for total demand for all recreation indicates that a high percent of the recreation days projected for 1980 and 2010 are directly associated with surface waters. Previous studies indicate a maximum carrying capacity of 325 annual recreation days per surface acre of water. To fulfill the water recreation demands, 79,000 acres



WALKER--MISSOURI COMMERCE

Future generations demand water for recreation.

of surface water in 1980 and 115,000 acres in 2010 are needed. Most of this water area must be supplied by man-made reservoirs.

Projected recreation demand for 1980 and 2010 is as follows:

Time Zone	1980	2010
(Recreation - Days)		
1 hour	22,310,436	57,455,413
1 to 1½ hours	1,627,176	6,050,116
1½ to 2 hours	1,141,688	3,167,888
2+ hours	632,319	1,853,845
Total Basin	25,711,619	68,527,262

The projections provide planning parameters used to determine the demand for recreation facilities on water-resource developments. They are to be used only for assurance that over-planning did not occur. It is recognized that present basic research is not complete, and the existing demand for recreation or the price people will pay either in transportation costs or entry fees cannot be accurately determined. However, planning guide lines are needed, and those used are the best available. Therefore, no attempt was made to plan recreation facilities to fulfill these demands completely. These are presented as general approximations and should be considered in that framework.

Emerging Problems

In the semi-urban area adjacent to St. Louis, the disgregation of farm units, because farm sections are going into subdivisions, is a problem for agriculture today. This problem will be greater as more and more people migrate into the metropolitan areas. When a portion of a farm unit is taken out of crop production and changed to residential use, an individual landowner may gain a considerable sum of money; however, an uneconomic-size farm unit is often left. Whether the operator waits for all of the farm to go to residential use or attempts to purchase enough additional land to make an economical unit, he is left with many difficult problems.

Urban sprawl is characterized by almost complete lack of planning and leaves large areas undeveloped. How to utilize this undeveloped land resource efficiently during the waiting period is a serious problem, not easily solved. The inflated value of this undeveloped land and the costs of holding it often eliminates many farm owners from farming or managing the land with any degree of efficiency. Thus, these farms are

often sold to people with substantial capital assets who hold the land for speculative purposes without any productive use.

The costs for transportation systems are increasing. Utilities, streets, school costs, and many other needs must be met with higher per capita costs than would be necessary if an orderly expansion were planned by developing on adjacent land before moving further out.

The influx of population and inevitable future shifts in land use will affect the decisions necessary for water-resource development that are made by agricultural interests as well as by town, city, county, State, and Federal governments. Therefore, many sections of presently undeveloped land should be acquired and developed by local governments for parks, green belts, and recreation areas.

The St. Louis and Jefferson County Planning Commissions are presently proposing the acquisition of approximately 45,000 acres of land along the lower Meramec River for the development of the Lower Meramec River Regional Park. Approximately 15,000 acres are bottom land, used primarily by agriculture, while the remaining area is the dissected hilly sections adjacent to the flood plain. Desirable areas such as this are available now in the Basin at a cost much less than expected in the future. Many such undertakings will probably require State and Federal assistance.

The present transportation system has generally been adequate. Without continued expansion, this will not be true in the future. An example of a future problem can readily be seen in the area near St. Louis. Because of the rapid increase in population, the use of existing highways and streets has often exceeded capacity. The problem will intensify as population continues to rise. With the construction of reservoirs and recreation facilities, a greater need for both primary highways and secondary roads will emerge.

Educational facilities will be crowded and overtaxed unless a concentrated effort toward expansion is made. The population is expected to double by 1980. Much of this expansion will include younger couples with school-age children. There will be need for more classrooms, school teachers, additional buses, and improved roads for student transportation. Much of the Basin will emerge from a rural atmosphere to one of semi-urban and urban. These changes create institutional problems needing community action.

Health problems will develop in the future as areas are built up and congestion becomes a fact. With adequately dispersed housing units, wells and septic tanks are satisfactory. But in concentrated areas and around many small

lakes, pollution is a serious problem. As urban areas are developed, problems of sewage disposal and contaminated water emerge. Costs of converting from individual systems to community systems create hardships for many home owners. If some form of zoning and control had been in effect in the past, many of these problems could now be avoided. As reservoirs, recreation facilities, and summer homes are built, sewage pollution may easily become a problem unless the development is controlled.

Regulation now is a much cheaper and easier method than later attempts to correct the problem will be. Institutional problems exist because local governments do not exercise the authority for orderly control of this expansion. An educational program to assist local officials is needed. If this approach fails, an amendment to the State enabling legislation or State control might be necessary.

The future needs of this increased population for food and fiber will certainly stimulate increased production in the agriculture section of the basic economy. Soils in the alluvial-flood plains have a potential for irrigation. Fruit and vegetable production under irrigation and nearness to markets has been economical in the past and should be even more so under future conditions. Additional capital will be needed by farm operators to allow them to expand into these enterprises. A system of local marketing should be developed. Improved methods of market news will be needed. Methods of new production technology must be adapted to stay competitive with other regions. Improved levels of management of farm operators should be promoted.

In areas of rapid population expansion, history of time-lag between the need for services and the funds to provide them is prevalent. Keeping assessed valuations current provides the tax base for income necessary for the many services needed. Assessments consistent with use should be practiced to prevent over-assessment of agricultural lands and a consequent tax burden to the agricultural economy. This may easily become a problem in the Meramec Basin.

In this rapidly expanding population, a need exists to provide jobs through additional industry. The problem of local unemployment and underemployment should be alleviated. Without an increase of local industry, future unemployment rates will likely increase. Also, additional pressures on the transportation by commuters could be reduced. Community action is needed to help in this effort.

Programs and projects should be planned and proposed with the ultimate solution to these problems as their primary objective. Allocation of resources to their best use, consistent with the needs of the population, will certainly tend to minimize future problems.

VII. PROGRAM AND PROJECT OBJECTIVES

Economic Development

An objective of the U.S. Department of Agriculture's program and projects for the Basin is to improve and accelerate the growth of the Basin economy by the following means:

1. Promote land treatment and guide land use to optimize the future agricultural production potential of the Basin with a minimum expenditure of economic resources.

2. Sustain agriculture through maintenance and improvement of the commercial family farm.

3. Provide opportunities for the marginal farm operator either to develop additional enterprises or to supplement his income by working off the farm.

4. Reduce unemployment and underemployment by creating an environment that will encourage new industries to locate in or near the Basin.

5. Provide opportunities for improvement and expansion of the agricultural industries.

6. Create new job opportunities through a major expansion of the recreation industry.

7. Continue a program of assistance to forest industries to increase their efficiency in the production, utilization, and marketing of wood products.

Land Treatment

The objective of the land-treatment program is to provide for optimum utilization of the land resource to satisfy current needs and at the same time conserve this resource for use of future generations through:

1. Application of land treatment measures to prevent erosion, improve fertility, and permit intensive use. ✓

2. Adjustments in land use to insure proper treatment and use of the land within its capability.

3. Incorporation of commercial on-farm recreation operations to increase the income of family-farm units.

4. Maintenance and improvement of habitat to provide for game and non-game wildlife species on crop and forest lands. ✓

5. Land-management practices to reduce sediment production that impairs public facilities, fish habitats, and channel capacities.

6. Provision for additional forest management personnel to interest and assist private woodland owners in the improvement and management of their forest lands.

7. Increase in forest fire prevention to control and enforce laws commensurate with improved forest values and increased use.

8. Broadened forest management techniques to benefit the varied uses of all forest areas and intensify the overall management programs on public lands.

9. Activation of forest land purchase programs in public forest areas to acquire public access to present holdings, recreational property, and unmanaged tracts of forest land to benefit and protect the public interest.

10. Activation of recreation plans on private and public lands to develop hiking and riding trails, hunter-camp sites, scenic views and other recreational activities.

11. The preservation of unique areas of natural beauty, historical, and scientific interest, to benefit the public interest.

12. The organization of soil and water conservation districts to carry out a program of sound resource treatment.

13. Establishment of a source to inform urban planners, developers, and municipal officials regarding advantages, limitations, and location of soils suitable for housing, recreation, road construction, and waste disposal.

Water Resource Development

The objective of the water-resource-development program is to meet the needs of agriculture, industry, municipalities, and the population as a whole by:

1. Reducing the flood damage to bottom lands of tributary streams and that portion of the main streams located above reservoirs planned by the U.S. Army Corps of Engineers.

2. Satisfying that portion of the recreational demand of the Basin as is allowed under existing water-resource-development programs of the U.S. Department of Agriculture.

3. Providing information regarding reservoir sites having permanent storage potential which cannot be constructed under current regulations of the U.S. Department of Agriculture but could be developed by other agencies or private enterprises.

4. Selecting reservoir sites for development that offer the best possibilities for permanent storage and utilizing the maximum practical capability of the site to provide for alternative storage allocations dictated by future needs.

5. Locating reservoirs to cause the least amount of disruption to existing facilities and providing improved road grades whenever possible.

6. Improving the hydrologic condition of the forested lands to reduce water runoff and improving surface water quality by erosion control.

7. Increasing and improving fish habitats.

8. Identifying water-resource-development projects that can be carried out under existing Federal, State, and local authorities.

VIII. PROPOSED PROGRAMS AND PROJECTS

After studying the present land and water-resource problems of the Basin, careful consideration of the future needs of the population for agriculture, nonagriculture, and recreation land uses, and the significant relationships between these problems and their effect on the economic development of the area, the U.S. Department of Agriculture proposes the following plan for development of the land and water resources of the Meramec River Basin. The USDA plan for resource development in the tributary areas is expected to satisfy the immediate needs of the Basin.

Land Treatment Program

The proposed land-treatment program is to encourage land and water uses that will yield continuing returns to the people of the Basin and of the Nation. The program places emphasis on accelerating the land-treatment measures that have a significant effect on reducing runoff, erosion, and sediment production. They are designed to protect and improve the agriculture and woodlands and increase overall farming efficiency.

A major objective in the land treatment program will be to control erosion on 240,000 acres of sloping cropland. The major land treatment practices to be applied are terraces,



MASSIE--MISSOURI COMMERCE

Wise land use--reduces soil erosion.

contour farming, grassed waterways, and special residue management coupled with a cropping system designed to reduce erosion to a minimum to prevent resource deterioration.

About 163,000 acres, now classified as cropland, are too steep and eroded for cultivated crops. This land should be seeded to permanent meadow or pasture. Some of it may be converted to woodland, wildlife land, or recreational areas.

About 50,000 acres of bottom land have a wetness problem. Most of this surface ponding or wetness, which originates from side-hill runoff, is aggravated by stream overflow. Diversion terraces placed to intercept runoff from side hills and convey the water to natural outlets through surface field ditches will help alleviate the on-farm drainage problem. Control structures may be needed where the field ditches empty into the stream. Land grading and smoothing, combined with a cropping system designed to prevent deterioration of soil structure, are some land-treatment practices needed on lands having a wetness problem.



Diversion ditches--protect bottom lands from side-hill drainage

The Conservation Needs Inventory indicates that nearly half of the pasture land has adequate cover to prevent soil erosion. However, for the pasture land to produce sufficient grazing to yield an economic return, at least 200,000 acres should be treated. High-level management of pasture land is accomplished by liming, fertilizing, reseeding improved pasture mixtures, and by fencing and developing additional water supplies for proper grazing control.



MASSIE--MISSOURI COMMERCE

Soil treatments--necessary for high production



WALKER--MISSOURI COMMERCE

Livestock water for better managed pastures

About two-thirds of the 1,250,000 acres of private woodland in the Basin is on land-capability classes VI and VII. Lands in these capabilities are suited only to grass, tree production and wildlife and recreational areas. The remaining one-third is in capability classes I to IV. With land-treatment measures applied, it could be used for cultivation if needed to meet the future production needs.

Livestock grazing is being permitted on 326,000 acres of on-farm woodlands. To maintain a good hydrological condition, livestock should be excluded from woodlands and increased fire-control measures be intensified on another 100,000 acres. A program of cultural woodland practices is needed to improve the private woodlands. These practices which include thinning, improvement cutting, and harvesting are important in maintaining desirable tree species in the highest possible productive condition. The most significant of these cultural measures



WOOLDRIDGE--MISSOURI CONSERVATION

Thinning woodlands--to improve quality and growth.

are the removal of culls for release of reproduction and selected crop trees on 728,000 acres, thinning on 31,000 acres, and intermediate and harvest cutting on 113,000 acres. For more desirable timber production, about 188,000 acres of private woodlands should be converted to other species. Some acres need more than one practice applied. About 28,400 acres of open land, including some public lands, can be planted primarily to pine. These open areas are unimproved pastures, abandoned fields with active erosion, and 3,000 acres of strip-mine areas.

There are approximately 17,000 acres that, with the proper treatment, can be converted to oak species. A much larger acreage, almost 149,000 acres, can easily be converted from the present hardwood type to one containing a dominance of short-leaf pine.

Nearly 200,000 acres in the proximity of the Clark National Forest are in private holdings. The activation of the forest-land purchase program is proposed to develop fully the recreation potential of the area and to acquire unmanaged forest areas so a program of land management will be applied for the benefit of the public.

A potential exists for creating on-farm recreation enterprises to strengthen the family farm unit. Heretofore, most on-farm recreation possibilities have occurred incidental to farming practices with little effort being made to capitalize on this resource. Now landowners are developing a portion of, or the entire farm into income-producing recreation enterprises. Sometimes private landowners can increase income by providing facilities such as picnic and camping areas close to existing or proposed recreational areas where these particular facilities are lacking. Technical assistance for planning installation and management of recreational facilities, fish and wildlife habitats, and other on-farm recreation enterprises is now available to landowners from State and Federal agencies.

Land-treatment measures used in soil and water conservation planning of farms are expected to be installed with technical services provided through a local Soil and Water Conservation District. The implementation of this program will require that nine additional Soil and Water Conservation Districts be organized in order to cover the Basin. At present, only 6 counties representing 35 percent of the Basin have organized Districts.

Other State and Federal agencies assist in various ways. The University of Missouri Extension Service provides recommendations for management and treatment. The Agriculture Stabilization and Conservation Service cost-shares on applied land-treatment measures. The Farmers Home Administration ex-



Plantings to provide food for wildlife



FOREST SERVICE

Wildlife ponds help increase and distribute wildlife.

tends credit to farmers for applying conservation measures. The farmers are assisted with their farm woodland management through the Farm Forestry Cooperative Program of the Missouri Conservation Commission cooperating with the U.S. Forest Service. The Soil Conservation Service provides technical assistance for planning and applying soil and water conservation measures through the Soil and Water Conservation Districts.

Water Resource Development

Investigations in all the major tributary streams and headwater streams of the rivers of the Meramec Basin revealed many instances of severe flood damage that can be prevented or at least greatly reduced by installation of upstream-water-shed-protection measures and flood-prevention structures.

In the tributary and headwater streams of the Basin, planned structural measures total 60 reservoirs. (Exhibits 38 and 39) Of these, 30 are multipurpose, flood-prevention, and recreation sites; 14 are single purpose, flood-prevention reservoirs; and 16 are single purpose, recreation lakes. (Map page 89)

Seven tributaries to the Bourbeuse River present opportunities for watershed protection and flood-prevention projects. (Map page 93) Eighteen upstream reservoirs in this area will provide flood protection to 20,000 acres of potentially productive bottom land. Fifteen of these sites have permanent storage capabilities for recreation pools totaling 4,280 surface acres and 103 miles of shoreline.

Several other sites in the upper Bourbeuse River area, although not included in the plan, offer attractive promise for public or private recreation developments.

In the Meramec River above Steelville, opportunities for flood prevention are good in three watersheds. Flood prevention is planned in 13 reservoirs. In six of these, multipurpose use is feasible and recreation developments are included. The proposed reservoirs have 1,300 surface acres and 30 miles of shoreline with surrounding areas that are excellent for recreation development.

Bottom lands of tributaries in the vicinity of St. Louis are rapidly being developed for housing, schools, and industry along with the required utility services and roadways. Already, many good flood-storage sites have been pre-empted by developments that preclude reservoir construction. There is little time but many opportunities to forestall like conditions in the other tributaries of this developing urban area. In 6 watersheds 13 structures are planned. (Map page 89) These

will give flood protection for bottom lands that will soon be needed for churches, schools, roads, houses, light industry, and parks. Of these sites, nine have additional water storage planned for recreational use. The sites would have 1,450 surface acres of water and 42 shoreline miles with desirable surrounding areas available to develop for intense recreational use. Such highly desirable facilities are often lacking in today's urban community.

Sixteen single-purpose-recreation lakes are included in the plan as an integral part of the recreation-development program of Clark National Forest. (Map page 89) These lakes average 227 surface acres and have a total of 100 shoreline miles. The recreational areas proposed for development--including facilities for fishing, boating, swimming, camping, picnicking, hiking, and horseback riding--will be administered by the Forest Service, who has the responsibility of providing recreational opportunities in the National Forests. These sites when fully developed will provide recreation for $1\frac{1}{2}$ million visitors annually.



MASSIE--MISSOURI COMMERCE

Water and woods--for relaxing and camping

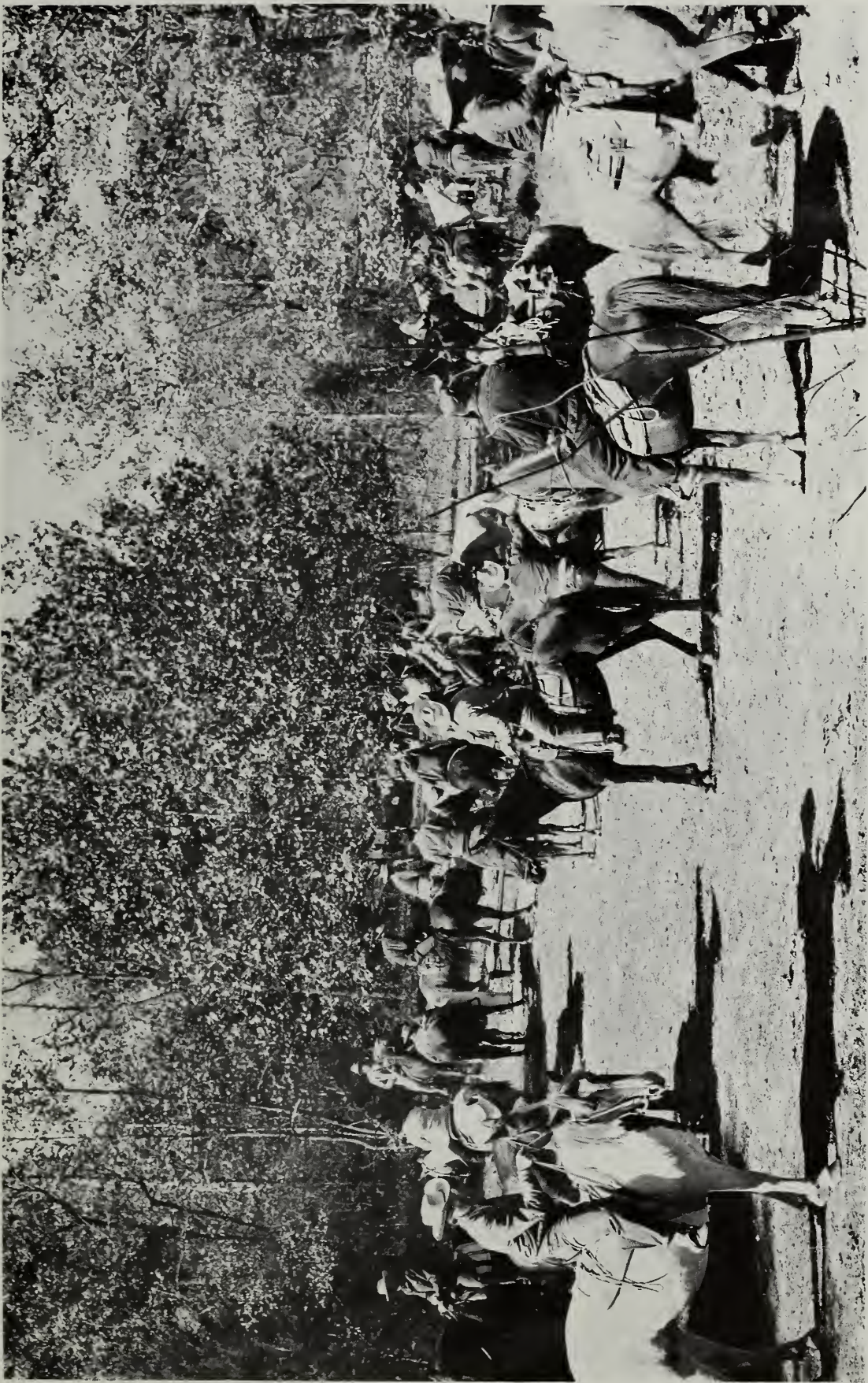


WALKER--MISSOURI COMMERCE

Reservoirs--popular for water associated recreation

Unless geological conditions precluded permanent water storage, the maximum practical storage potential of the flood-prevention sites was determined for recreational use. (Exhibit 40) In the future, other needs may pre-empt the recreational use of water, and in these situations its storage may be reallocated to other uses such as water quality, irrigation, or municipal and industrial supply.

During the course of the investigations, over 40 sites were located that are suited for development as public or private recreation reservoirs but have minor flood-protection benefits. (Map page 91) There are undoubtedly many more not located. Some sites are near communities and towns experiencing adverse economic conditions. The development of these lake sites--including recreation facilities--could reduce the unemployment and underemployment which is now plaguing these areas. Local community betterment organizations are in a good position to make such developments possible.



POTOSI INDEPENDENT JOURNAL

Green belts--provide opportunities for new experiences.

Water-oriented outdoor recreation is one of the important uses of the water area of the proposed reservoirs. Even on single purpose flood-control structures some incidental recreation will occur.

Although elaborate facilities are not required, high-quality installations are necessary. Multiple facilities for various uses and the zoning of activities are recommended for each area in order to increase the recreational use capacity of the reservoir and the quality of the recreation experience.

The facilities recommended for development include, but are not limited to: access roads, parking areas, picnic tables, shelterhouses, playground equipment, camp-site equipment, hiking and riding trails, landing docks, bath houses, swimming beaches, fishing piers, water supply, showers, toilets, sewage treatment, waste disposal, and maintenance buildings and equipment.



FOREST SERVICE

Nature is to be enjoyed.

In the study on the Meramec River Basin, by the U.S. Department of Agriculture, several watersheds were found to present opportunities for development under Public Law 566--The Watershed Protection and Flood Prevention Act, as amended. Under this Act these watersheds may be developed if sponsored by qualified local groups. (Exhibit 41) Discussed below are those watersheds that show opportunities for development. (Map page 93)

The UPPER MERAMEC WATERSHED covers an area of 348.9 square miles above the junction of Dry Fork. The Meramec River and its three large tributaries--Crooked, Benton, and Dry Valley creeks drain the area. It can be developed as one watershed or CROOKED CREEK WATERSHED and the remaining Upper Meramec River Watershed can be developed independently.

The area lies primarily in the Dent County Soil Conservation District and in Crawford County with small drainage areas in Phelps and Iron counties. The southern and eastern one-third of this watershed is within the boundaries of the Clark National Forest. It has 7,573 acres of bottom land that flood frequently.

Ten structures are planned for flood prevention of the bottom-land acres. These 10 structures control the drainage area on 123 square miles. Two of these structures are single purpose flood prevention; because of the geology they are not expected to hold water permanently. Six are multipurpose flood prevention and recreation reservoirs. Two single purpose recreation reservoirs are located in the Clark National Forest where they will help develop the full recreation potential of the Forest. The 8 reservoirs having recreation storage will provide 1,650 surface acres of water and shorelines of 42.7 miles.

DRY FORK CREEK WATERSHED, a tributary to the Meramec River, covers an area of 386 square miles. This area is in Texas, Dent, and Phelps counties. There are 5,468 acres of bottom land in the watershed that are flooding every other year.

To reduce the flooding, 5 floodwater-retarding structures have been planned with a controlled drainage area of 125 square miles. Because of the geology of the area, no permanent water storage is planned in four of these structures. Structure No. DF-28 will hold permanent storage, and recreation could be included if the waste effluent from the Salem sewage plant were by-passed.

The BOONE CREEK WATERSHED is located in Crawford and Franklin counties and has a drainage area of 51.2 square miles. The bottom land area is about 700 acres. One multi-

purpose reservoir for flood prevention and recreation is proposed. In addition to protecting the bottom land from annual flooding, provisions are made for recreation with a 335-acre lake.

The LITTLE BOURBEUSE RIVER WATERSHED has about 60 square miles of drainage area and is located in Crawford and Franklin counties.

To protect over 1,200 acres of good bottom land subject to flooding, 2 floodwater-retarding structures with a controlled area of 29 square miles are proposed. In addition to flood prevention, recreation storage is also planned. The structures provide recreation pools of about 635 acres.

BRUSH CREEK WATERSHED has a drainage area of 75.2 square miles. It is located in the northwest corner of Crawford County and extends a short distance into Gasconade County. This watershed was selected as a representative area and studied in detail.

Of the total watershed area, 3,177 acres of bottom land are located on Brush Creek and its 3 main tributaries--Prairie, Pleasant Valley, and Souder creeks.

Flooding is a serious problem, causing direct damages to crops and delays in planting. Some crops have to be replanted annually.

Sites suitable for flood prevention with additional storage volume for recreational use are available. To control over 50 percent of the drainage area of the watershed, 3 reservoirs are planned in addition to Indian Hills reservoir already in place. Indian Hills Dam, developed by private enterprise, forms a 325-acre recreation lake. Land surrounding the lake has been subdivided into building lots.

The UPPER BOURBEUSE WATERSHED covers an area of 82.3 square miles and is the headwaters of the Bourbeuse River. The major part of the drainage is in northeast Phelps County with small amounts from Crawford and Maries counties.

There are 1,357 acres of bottom land that have a serious flooding problem. Some road and bridge and other agricultural damages are also occurring.

Two floodwater-retarding structures with a combined drainage area of 62 square miles are proposed for flood prevention, both within and outside the watershed. These two structures have good potential for recreation water storage and were planned for multipurpose storage. The combined surface area of the recreation pools is estimated to be 1,190 acres.

The LANES FORK WATERSHED is a tributary to the Bourbeuse River with a drainage area of 48.3 square miles. Almost all of the drainage area lies within Maries County with minor amounts in Phelps and Gasconade counties.

There are 1,121 acres of good bottom land flooding annually. Some road and bridge damages occur also.

One multipurpose reservoir is planned for protection of the flood plain and for recreation. The drainage area of the reservoir is 23 square miles. This is an excellent recreation site since it is located at State Highway 68 and forms a lake with 430 acres water surface.

DRY FORK WATERSHED is the largest tributary to the Bourbeuse River. It occupies an area of 119.7 square miles. The headwaters are in Maries County and the lower one-half is in the Gasconade County Soil and Water Conservation District.

There are over 4,000 acres of good bottom land in Dry Fork and its tributaries that flood almost every year. Dry Fork also affects the flooding of the Bourbeuse River flood plain below the point of confluence.

In order to reduce flooding in the watershed and on the Bourbeuse River, 6 structures for flood prevention have been planned with controlled drainage on 53 square miles. Three are to be multipurpose with recreation storage. The remaining three will not hold permanent storage because of the geology of the area.

The three multipurpose reservoirs will have a total of 450 surface acres for recreation in addition to the flood-prevention features.

RED OAK WATERSHED is located in the Gasconade and Franklin County Soil and Water Conservation Districts and is a tributary to the Bourbeuse River. It occupies an area of 64.3 square miles with almost 1,500 acres of flooding flood plains. The floods are frequent and severe.

Three multipurpose flood prevention and recreation reservoirs are planned to protect the flood plain and provide about 600 acres of water for outdoor recreation. The 3 reservoirs will control about 30 square miles of the 64-square mile drainage area.

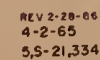
In the metropolitan St. Louis area land values are high and the structure sites are rapidly being pre-empt by urban and residential developments.

The following watersheds are located within this rapidly urbanizing area:

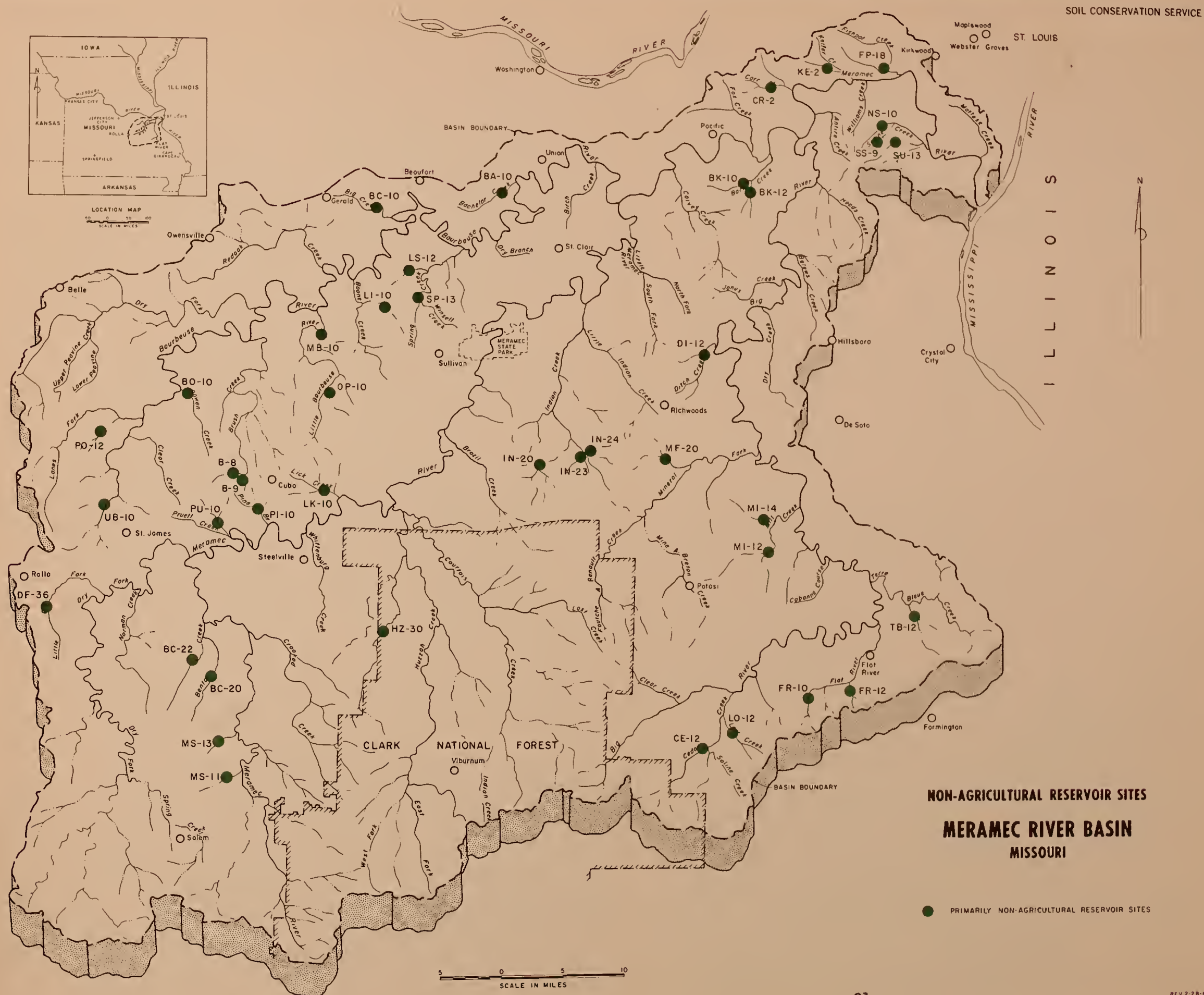
	<u>Square Miles</u>		<u>Square Miles</u>
LITTLE MERAMEC	36.1	ANTIRE CREEK	9.9
CALVEY CREEK	41.6	BELEWS CREEK	26
FOX CREEK	19.1	DRY CREEK	29.6

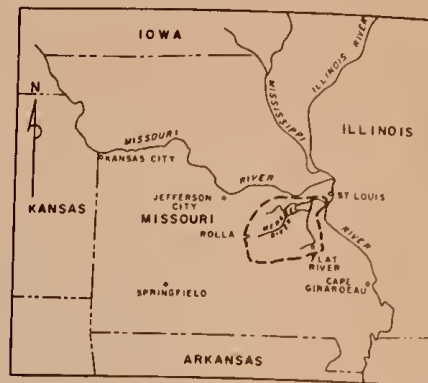
Measures planned in these watersheds are for the protection of the present and future urban development on the flood plains. A total of 975 acres of flood plain are to be protected on a 100-year frequency. The 13 structures planned have a drainage-area control of 80 square miles out of a total of 161 square miles.

These watersheds, as PL-566 projects, will need to be evaluated on their individual merits at the time of implementation.

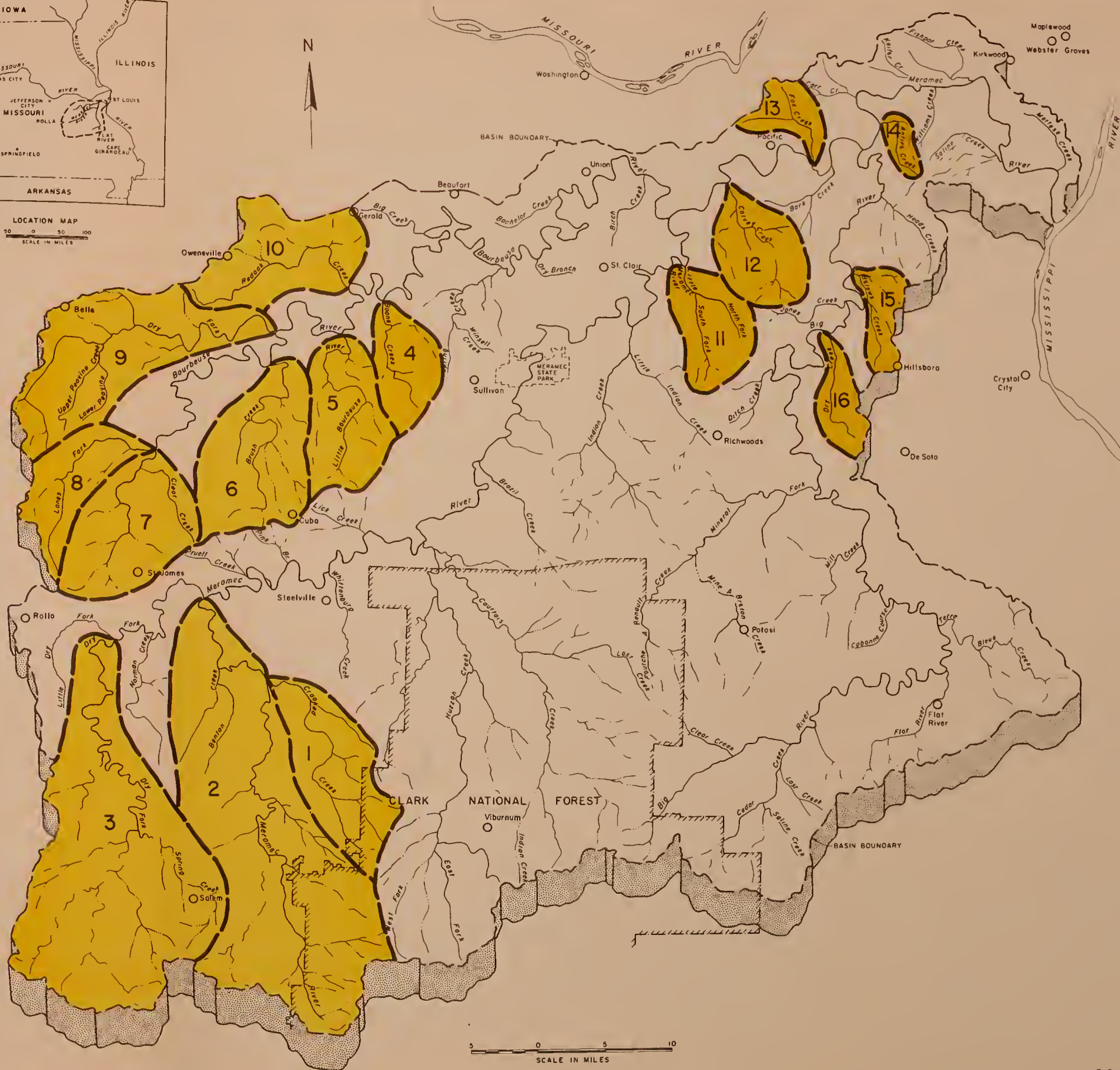








LOCATION MAP
0 50 100
SCALE IN MILES



WATERSHED IDENTIFICATION

1. Crooked Creek
2. Upper Meramec River
3. Dry Fork Creek (Meramec)
4. Boone Creek
5. Little Bourbeuse River
6. Brush Creek
7. Upper Bourbeuse River
8. Lanes Fork Creek
9. Dry Fork Creek (Bourbeuse)
10. Redoak Creek
11. Little Meramec River
12. Calvey Creek
13. Fox Creek
14. Antire Creek
15. Belews Creek
16. Dry Creek

NATIONAL FOREST BOUNDARY

POTENTIAL P.L. 566 PROJECTS
MERAMEC RIVER BASIN
MISSOURI

0 5 10
SCALE IN MILES

IX. IMPACTS OF PROPOSED PROGRAMS AND PROJECTS

Physical

The influence of programs and projects proposed to help satisfy the needs in the Basin is expected to bring about major land use changes. By 1980 37,000 acres of cropland, nearly 58,000 acres of pasture, and almost 131,000 acres of private woodland will shift into other uses. Most of this land will shift into urban expansion, reservoirs, and recreational facilities, but lands in public forests are expected to increase by 19,000 acres.

By 1980 it is estimated that 48 percent of the land will be in farms. Cropland is estimated at 524,300 acres and pasture land at 305,500 acres. Within commuting distance of St. Louis, some crop and pasture land will be intermingled with small farms used as suburban residences. The crop and livestock production will mostly come from commercial family farms. The size of farm units will increase where necessary to maintain an efficient unit under intensive farming operations.

Essential to the successful improvement of the existing agriculture and the individual farm is to provide for using the land within its capabilities and the treatment in accordance with its needs for sustained agricultural production. The application of land-treatment measures along with land use within its capability will reduce erosion to an acceptable standard and will help maintain the productivity of the soil. Better land use and erosion-control practices will reduce sediment in the flood plains, streams, and reservoirs. Reservoirs will provide additional control of sediment. Land treatment and structural measures will contribute to the reduction of stream turbidity.

The installation of floodwater-retarding structures will reduce the floodwater damage on fertile bottom lands. This reduction will provide the incentive for more intensive and more efficient use of bottom lands and will encourage a shift of cropland from upland areas not suitable for cultivation.

Drainage improvement of the bottom land will be practical after the reduction of floodwater damages. Improved drainage will reduce the hazard of farming and will promote an increased fertilization program and application of modern farming technology--including timely planting and harvesting.

The protection from flooding, the drainage of bottom lands, and the availability of water supplies in the multi-purpose reservoirs will provide an incentive for developing supplemental irrigation as needed.

The management of agricultural land and the commercial family farm will be improved to support a higher standard of living. The potential for enhancement of the commercial family farm will attract better management.

Total resources of the farm will be managed to improve the farm business enterprises. Cropland will be protected and used more intensively, pastures will be improved, livestock programs will be developed to fit the land resources, woodlands will be managed for supplemental income, and many farms will develop on-farm recreation facilities. The returns from recreation use of the land will greatly exceed previous income. The results of forest management on the National and State forest lands, as well as private woodlands, will encourage more farmers to seek available assistance in woodland management.

With the building of the USDA water-control projects, land will transfer from present uses into reservoirs and recreation facilities. By 1980 the proposed projects will need a total of 27,940 acres. Over 11,000 acres of this will be required for recreation facilities. This land will be removed from areas in forest, pasture, and cropland.

Total lands proposed for reservoirs and recreation facilities by the USDA and other reports are expected to be 107,000 acres in 1980 and 150,000 acres in 2010. Lands around the proposed reservoirs will be used intensively by people seeking outdoor recreation associated with surface waters. Over 60 percent of these lands have woodland cover; they will require a high level of management to maintain their characteristics and make them desirable for recreation.

The shift of use emphasis from cropland, pasture, and woodland to recreation will cause additional land changes. It is anticipated that large acreages adjacent to reservoirs will be purchased for residential use. This, in turn, will require additional land for transportation systems and related services for a rapidly expanding population in the area. The total shift in land use because of other uses is expected to be 299,000 acres by 1980 and 447,000 acres by 2010.

Economic

As population in the Basin continues to increase, so will the number of people employed. The trend of decreasing employment in agriculture and increasing employment in nonagriculture will continue. This will be especially significant in the northeastern section of the Basin.

The implementation of the proposed plan should make a significant increase in industry, recreation, and associated



Reservoir developments will increase income and employment.

businesses. Operation and maintenance of the recreation facilities associated with the 46 planned reservoirs will provide employment for an estimated 250 people. At least that many more will be needed to provide the services required by the additional 4.2 million recreationists visiting the area. A significant increase in the building and construction industry should provide increased employment.

In 1959, approximately 7,000 farms were in the Basin while estimates place the present number at about 6,500. Projections indicate that the number of farms will decline to 5,200 by 1980 and that the number of farm operators will also decline nearly 20 percent from 1960 to 1980. In line with these trends, approximately 10 percent of the labor force in 1980 would be classified as agriculture and 90 percent non-agriculture. The remaining farmers on fewer farms of larger size should have units of sufficient size for them to be fully employed. People who were formerly engaged in agriculture and make up the 20 percent leaving the farm should find employment in the immediate area because of the increased business activity.

The installation of the proposed plan for the development of the land and water resources will result in an increase in crop production and of livestock and livestock products. The increased demands for food by the population, along with improved technology, flood protection for the flood plains, land treatment and water management for soils subject to erosion, and water available for irrigation as needed, will cause rapid changes in the agriculture economy in future years. The gently rolling lands that are in grass and pasture may be converted to more intensive farming with the application of complete water-management systems. Flood-plain land that is presently being used below capacity, because of the high flood risk, will be farmed more intensively. With flood-control structures operating in conjunction with applied land treatment and water management practices, yields are expected to increase and total production will be greater on fewer acres.

Projections for 1980 indicate an average increase of 13.4 percent in total production for the Basin with resource development. This is over and above the normal projected increase without development. The percentage increased production for each crop is as follows:

Corn	10.3%	Soybeans	15.7%
Wheat	11.8	Sorghum	7.4
Oats	8.7	Hay	26.8

Optimum use of the agriculture resource base of the region should occur with these proposed programs. This will generate benefits to the farm operators, business men, and consumers in the area.

The increase in the total number of people employed raises the total income for the area. Much of the increase in employment will occur as a result of project implementation, of increased economic activity, and of people visiting the area to participate in water-oriented outdoor recreation. Studies conducted by the University of Missouri concerning expenditures of recreationists in the Lake of the Ozark region indicated a daily expenditure between five and six dollars per day--including food, gasoline, souvenirs, boats purchased in the area, taxes, and repairs on recreation property and many other items. This is a gross expenditure that adds to the total economic activity of the Basin. Using the conservative figure of \$5 per day for 4.2 million visitors to the USDA reservoirs, the increase in total income would be in excess of \$20 million per year.

Income in the agriculture sector of the economy will grow as a result of the increased yields and production. Using current normalized prices, this income will increase to 2.2 million dollars annually by 1980--over \$400 per farm.

The rapidly increasing population with rising incomes demand an ever increasing amount of livestock products for their consumption. From the increased production of grains, pasture, and hay, farmers can increase their production of livestock. The total income from livestock is estimated to be almost 30 million dollars by 1980--an increase of approximately 12 million dollars over 1960.

By 1980 and through 2010, we can expect continuing changes of the agriculture economy. Improvements resulting from the project will increase farm income and reduce costs of production while recreational use of lands will contribute an additional income for many farm owners and operators.

Project Benefits and Costs

The benefits from the proposed land-and-water-resource programs and projects are both monetary and non-monetary. The benefits from land treatment have a measurable effect upon the income of the individual farmer. Research and past experience have shown benefits from land treatment greatly exceed the cost of application. The reduction of runoff, erosion and sediment production from the application of land-treatment measures play a vital role in maintaining and extending both the physical and economic life of the structures.

The flood-prevention benefits stem from 30 multiple purpose structures and 14 single purpose structures. Over 35,500 acres of bottom lands will be protected for agricultural production and urban enhancement. Benefits to agriculture are

largely from the reduction of floodwater damage to crops and pasture and enhancement of the bottom lands for increased production. With protection from flooding, cropland can be used more intensively through higher applications of fertilizer and better crop rotations, and flood-plain land that is presently in pasture and woodland can be converted to cropland. Other benefits will accrue from the reduction of floodwater damage to fences, roads, and bridges and from debris removal. The monetary benefits, accruing annually from the 60 proposed structures of the USDA, are \$6,765,100. Flood prevention and recreation average annual benefits for the major sub-basins are the following:

Sub-basin	Flood Prevention	Recreation	Total
Bourbeuse River	\$270,300	\$2,358,900	\$2,629,200
Meramec River	251,800	3,370,000	3,621,800
Big River	86,700	427,400	514,100
Total	\$608,800	\$6,156,300	\$6,765,100

The increase in production of food and fiber will foster an increase in the business activity of the transporting, processing and marketing industries. The income realized from the added handling, supplying, and servicing required will increase the net returns claimed as secondary benefits.

Monetary redevelopment benefits that are expected from the installation and operation of the project have not been evaluated. During construction, an opportunity will arise which can utilize the unemployed or underemployed people of the area. The normal project operation and maintenance, the operation of recreational facilities, and the secondary businesses associated with the developments will provide opportunities for continuing employment. In addition to the primary benefits, secondary benefits--additional employment and expanding economic activity in the area--will increase the benefits attributed to project installation.

The reservoirs planned for recreational use were located with the least possible travel time from the major source of demand as was physically and economically possible. (Map page 89) The reduction of total travel cost as well as travel time of the recreationist resulted. Since total leisure time allocated by an individual to outdoor recreation is usually limited, travel time often determines participation. With the best possible location for the entire complex of reservoirs, a large segment of total leisure time will shift from travel time to actual participation in recreational activity. Although it is extremely difficult to measure this benefit in monetary terms, it is a real benefit to the population of the area and a very important factor in planning water-resource development.

With ideal topography, high quality facilities, good accessibility and the zoning of activities, the capability of the reservoir sites to satisfy the recreationist is high. The USDA reservoirs have the recreation capacity to satisfy approximately 4.2 million days of the recreational demand. The proposed development of the land and water resources by private developers, State or other Federal agencies will satisfy a large percentage of the 1980 demand. The recreation demands of the population for each time zone in 1980 and potential recreation days that can be supplied by USDA reservoirs are:

Time Zone	Demand	Supply
1 hour	22,310,436	88,655
1 to 1½ hours	1,627,176	902,681
1½ to 2 hours	1,141,688	1,144,128
2+ hours	632,319	2,089,276
Total Basin	25,711,619	4,224,740

Using the assumption that people will tend to satisfy their needs in the closest time zone possible, the excess demand will overflow from the center to the nearest facilities. All USDA reservoirs are within 2½ hours driving time of St. Louis; therefore, all facilities will be available for weekend use and many for daily use.

Many benefits of the proposed project are non-monetary in nature and impossible to evaluate in monetary terms. The increased economic activity creates many of these additional benefits. When a commuter finds employment close to his residence, a reduction in daily travel allows him more leisure time to spend with his family, work around the house and yard, and participate in social and community activities. As a consequence, schools, churches, and social organizations flourish instead of decline. Simply living in a progressive, active community has a certain satisfaction for many people.

Many of the important non-monetary benefits that will accrue as the project is developed and used are closely inter-related and are a result of another benefit. Though it is difficult to evaluate these in monetary terms, they are a significant factor in the formulation of a plan for water-resource development in the Meramec River Basin.

With any proposed developments non-monetary costs as well as benefits are present. Both monetary and non-monetary costs are often incurred during a time period prior to realizing the benefits. Many times the tax base does not expand rapidly enough to pay these additional expenses--access roads, health protection, police protection, and many other items. Addition-

al laws and regulations are often needed in an area that is changing from a sparsely populated rural community to a heavily populated urban community.

The installation cost for the proposed 60 structures is \$17,507,690; cost for the recreation facilities around 46 of these structures is \$9,670,800. Thus, the combined installation cost of the structures and the facilities is \$27,178,490. Project installation costs by purposes for these 60 reservoirs in the USDA plan are the following:

Item	No.	Flood Prevention	Recreation	Recreation Facilities
<u>Single Purpose</u>				
Floodwater Retarding Structures	14	\$2,978,190	-0-	-0-
Recreation Structures	16	-0-	\$ 4,081,000	\$5,337,300
<u>Multiple Purpose</u>				
Floodwater Retarding and Recreation Structures	30	4,328,330	6,120,170	4,333,500
Total	60	\$7,306,520	\$10,201,170	\$9,670,800
Single and Multiple Purpose Structure Cost				\$17,507,690
Recreation Facilities Cost				9,670,800
Total Cost				\$27,178,490
(Exhibits 44 and 45)				

The annual costs of the reservoirs and recreational facilities, including the cost for operation and maintenance, are the following:

	Recreation	Flood Prevention	Total
Single and Multi-purpose Structures	\$ 340,930	\$ 251,700	\$ 592,630
Recreation Facilities	1,573,280	-0-	1,573,280
Total	\$1,914,210	\$ 251,700	\$2,165,910

(Exhibits 48 and 49)

The forming of institutional organizations--legal subdivisions of the State of Missouri--will be needed to operate and maintain the recreational facilities and support the associated activities. Some form of organization will be necessary to coordinate implementation, operation, and maintenance of the reservoir complex. Many of these costs must be borne by local people--other than the Federal government. The rate of implementation and success of the development will be in direct proportion to the ability and willingness of the local people to fulfill their responsibility.

SECTION X

APPENDIX

CONTENTS

Exhibit

1	Descr.	Plan of Work
2	Table	Percent of Total Basin Area in Each County, 1963
3	Table	Percent of Total County Area in Each Resource Area, 1963
4	Map	Major Land Resource Areas and Conservation Needs Inventory Sample Areas
5	Map	Meramec Basin Land Use
6	Table	Estimated Land Use Distribution by Counties, 1958
7	Table	Estimated Land Use Distribution by Counties, Land Resource Areas and Basin, 1958
8	Map	Reconnaissance Land Capability Map
9	Table	Percentage of Nonagriculture and Agriculture Employment by Counties
10	Table	Forest Industry by Type of Product Manufactured in the Meramec Basin, 1963
11	Table	Gross Returns Attributed to Timber, 1963
12	Descr.	Soil Groups - By Productivity
13	Descr.	Land Use Capability Classification
14	Table	Estimated Land Use Distribution by Soil Groups, Land Resource Area and Basin, 1958
15	Table	Normalized Yields of Crops and Pasture, by Land Resource Area, 1958
16	Table	Normalized Acreage of Cropland Use by Soil Groups, by Land Resource Areas and Basin, 1958
17	Table	Normalized Acres, Yield, and Production, 1958
18	Table	Normalized Production of Crops by Soil Groups, Land Resource Areas and Basin, 1958

CONTENTS
(Continued)

Exhibit

19	Table	Acres, Yield, Production, and Value of Crop Production, 1959
20	Table	Production and Value of Livestock and Live-stock Products, 1959
21	Table	Rank of the Counties According to Their Relative Gross Productivity per Acre of Land, 1950
22	Table	Forest Land Area in the Meramec Basin by Stand Size Class and Resource Area
23	Table	Net Timber Volume on Commercial Forest Land by Resource Area, Species Group, and Size Class
24	Table	Forest Land Area by Site Productivity Class
25	Table	Utilization by the Basin Population of the Major Farm Products Produced, 1980-2010
26	Table	Feed Unit Needs of Basin Population
27	Table	Potential Feed Units
28	Table	Potential Acres of Cropland with Maximum Use
29	Map	The Meramec Basin Region, Highway Travel Time
30	Table	Present and Projected Population by Time Zones
31	Table	Recreation Demand by Time Zones, 1960
32	Map	Existing Recreation Areas
33	Table	Projected Harvested Acres, Yield, Production, 1980, Without Project Installation
34	Table	Projected Harvested Acres, Yield, Production, 1980, With Project Installed
35	Table	Projected Harvested Acres, Yield, Production, 2010, With Project Installed

CONTENTS
(Continued)

Exhibit

36	Table	Recreation Demand by Time Zones, 1980
37	Table	Recreation Demand by Time Zones, 2010
38	Illus.	Dry Basin Type Earthfill Dam
39	Illus.	Monolithic Drop-inlet and Conservation Pool
40	Map	Geologic Site Investigations (Surface)
41	Descr.	P.L. 566, Watershed and Flood Prevention Act, as amended
42	Illus.	Chute Spillway
43	Illus.	Earthfill Dam with Concrete Drop-inlet
44	Table	Recreation Facilities Installation Cost
45	Table	Structure Installation Cost
46	Table	Structure Data, Multipurpose and Single Purpose
47	Table	Structure Data, Recreation
48	Table	Annual Cost for Structures
49	Table	Annual Recreation Costs

PLAN OF WORK FOR PARTICIPATION BY THE
UNITED STATES DEPARTMENT OF AGRICULTURE
IN A SURVEY AND INVESTIGATION OF THE
MERAMEC RIVER BASIN, MISSOURI

I. INTRODUCTION

The Meramec Basin, including the Meramec, Bourbeuse, and Big River Watersheds, embraces 3,980 square miles in all or part of 15 counties immediately southwest of St. Louis, Missouri.

The Basin is primarily rural, about one-half the 200,000 population being located in suburban areas near St. Louis. This area is characterized by predominantly forested headwaters, steep slopes and narrow valleys, with broadening flood plains downstream where agricultural and other uses are found in increased amounts.

Many previous studies of the Meramec River Basin have been made by several agencies since 1930. The Department of Agriculture has participated in a number of these studies since 1943. More recently, the U.S. Corps of Engineers has been authorized by Congressional resolution dated April 1960, to undertake a new comprehensive study of the Basin, which will result in the "Formulation of a plan to provide the best use or combination of uses of water and related land measures to meet all foreseeable short and long-term needs and thus insure maximum benefits to the Meramec Basin and to the economy of the Nation."

A request for participation of the Department of Agriculture in a coordinated survey effort in the Basin was made by the St. Louis District Office of the U.S. Corps of Engineers to the Administrator of the Soil Conservation Service under date of September 25, 1961. The U.S. Corps of Engineers also has requested the Department of Agriculture to provide certain specific information, which will be included in the survey.

Participation in a cooperative comprehensive river basin survey by the Department will be under authority of Section 6 of Public Law 566 and in accordance with the Memorandum of Understanding dated February 2, 1956, between the Administrators of SCS, ERS, and the Chief of FS. The principal participants within the Department of Agriculture will be the Soil Conservation Service, the Forest Service, and the Economic Research Service. Solutions to potential problems will be sought under existing authorities of the Department and under additional authorizations to the Department.

Existing information from the reports of previous studies, as well as available information from various Federal, State, and private sources, will be used to the extent it is suitable for the purpose. This plan of work assumes that proper mechanisms will be established to facilitate coordination of the Department's efforts with those of other Federal and State agencies.

It is contemplated that the survey will be completed and necessary reports be in final draft by late fiscal year 1965. Interim reports may be issued as required to effect proper inter-agency coordination during the course of the survey.

II. OBJECTIVES

The purpose of the Department of Agriculture's participation in the survey is to contribute to a comprehensive plan for the coordinated and orderly development, management, and use of the water and related land resources of the Meramec River Basin. Such a plan would provide for the highest level of long-term benefits to the people of the basin, adjacent communities and the nation.

The plan will encompass the following:

- A. Identification and design of an interrelated system of structural measures for water control and water resource development and a pattern of related land use and treatment whereby long-range project needs are effectively satisfied.
- B. Identification of those elements of the overall water management and control system and land use required to satisfy immediate needs.
- C. Identification of those elements of the plan which should be carried out by the USDA.

III. PRINCIPAL FEATURES OF USDA STUDY

- A. Inventory and classify land resources of the basin in terms of present and potential use, physical characteristics, condition, and management level.
- B. Analysis of current and long-range water management needs with regard to erosion control and sediment reduction, flood prevention, water supply, water quality control, fish and wildlife, and outdoor recreation.
- C. Inventory of the use of natural resources by agricultural and forest enterprises and related industries and their contribution to the present and prospective economic activity and employment in the river basin.

- D. Appraisal of the relationship of agricultural water problems and needs to economic development.
- E. Appraisal and projection of demand for use of land and water for recreational purposes.
- F. Appraisal of land and water resources available for potential recreational use.
- G. In cooperation with other concerned agencies consider alternate methods of water and related land resource development and participate in the formulation of a plan of development for the basin.
- H. Consideration of institutional problems and requirements for effective implementation and management.

IV. SCOPE AND RESPONSIBILITIES OF USDA AGENCIES

The survey work of the U.S. Department of Agriculture in this basin will be coordinated by a USDA Field Advisory Committee composed of Howard C. Jackson, State Conservationist, Chairman, Soil Conservation Service; A. C. Richey, Chief of Cooperative Watershed Management Branch, Region 9, U.S. Forest Service; and Nathan G. Mallett, Economic Research Service.

The Field Advisory Committee will be responsible for field coordination of the Department survey activities and procedures, arranging for field review of recommendations and reports, arranging for necessary consultations, overall relationships with the U.S. Corps of Engineers, and other interested State and Federal agencies, and arranging for overall schedules of work. Each member of the Field Advisory Committee will inform his responsible supervisor about progress and effort necessary for timely performance.

The responsibilities of each of the cooperating agencies under this plan of work are as follows:

SOIL CONSERVATION SERVICE

The Soil Conservation Service will undertake and be technically responsible for the following aspects of the survey, including arrangements for necessary technical consultation and assistance from staff members of Forest Service and Economic Research Service and with appropriate Federal and State agencies.

1. Inventory and classify land conditions, soils, erosion, and land use by land resource areas within the Basin.
2. Recommend land use adjustments and treatment to assure maximum utilization of the land resource within the capa-

bility of the lands. This will include consideration of potential recreational lands including income producing recreational use of farm lands.

3. Appraise and analyze water management needs in the Basin.
 - a. Delineate subwatershed areas into appropriate hydrologic units for purposes of the study.
 - b. Identify floodwater and sedimentation problems in the subwatersheds.
 - c. Appraise agricultural water management needs including irrigation and drainage.
 - d. In cooperation with other agencies appraise nonagricultural water management needs in the subwatershed areas, including municipal and industrial water supply, water quality control, recreation and fish and wildlife enhancement.
4. Determine water management needs outside of the subwatershed which may be served by project-type water resource developments within the subwatersheds.
5. Appraise the physical potentials and development costs of using rural water and related land resources for recreational purposes.
6. Investigate potentials for water storage developments within the subwatersheds which will provide for needs both within and outside the subwatersheds.
7. Participate in preparation of recommendations for water resource development within the subwatersheds which takes account of the physical and economic relations in and outside the subwatersheds and is coordinated with other proposed developments in the Basin plan.
8. Consider institutional problems and requirements as related to agricultural land resources for effective implementation and management.
9. Prepare a report covering USDA survey.

FOREST SERVICE

The Forest Service will undertake and be technically responsible for the following aspects of the survey, including arrangements for necessary technical consultation and assistance from staff members of SCS and ERS, and with appropriate Federal and State agencies.

1. Inventory, classification and correlation of forest resources of the Basin in terms of present and potential use, physical characteristics, condition and management levels by land resource areas, including:
 - a. Conduct additional field surveys as indicated for expansion of existing or lacking necessary data.
 - b. Preparation of material on National Forest Multiple Use Management as it relates to the overall USDA Basin Study.
2. Analysis of Forest Resources as related to current and long-range Water Management Needs with regard to erosion control, flood prevention, water supply, water quality, and recreation.
 - a. Determination and analysis of hydrologic and related forested watershed management needs in subwatersheds as required, including determination of hydrologic indices to be used in runoff determinations.
 - b. Determination of overall forestry programs and needs, as part of land treatment recommendations.
3. Inventory and analysis of the use of natural resources by forest based enterprises and related industries and their contribution to the present and prospective economic activity and employment in the basin.
4. Appraisal of the relationship of forest resources to agricultural water problems and needs. Correlate with SCS and ERS in the appraisal of the related economic development.
5. Appraisal of physical potentials and development costs of using forest land resources for recreational purposes.
6. Participation in correlation of forestry phases in development of the basin plan.
7. Consideration of institutional problems and requirements as related to the forest resources for effective implementation and management.
8. It will assure that there is correlation between this survey and the National Forest Impact Survey Report submitted by the Forest Service to the District Engineer, Corps of Engineers, early in 1963.

ECONOMIC RESEARCH SERVICE

The Economic Research Service will undertake and be technically responsible for the following aspects of the survey, including arrangements for necessary technical consultation and assistance from staff members of SCS and FS, and with appropriate Federal and State agencies.

1. Compilation and analysis of secondary statistical materials related to the agricultural economy of the basin, use of land and water resources by the agricultural industry, the resulting output of agricultural products, and levels of employment in agricultural and related economic activities.
2. A reconnaissance type appraisal of emerging improvements in agricultural production technology, growth of agricultural markets, inter-regional competition, and their likely composite consequences for the agricultural economy of the basin and its needs for natural resources.
3. Review of other studies and supplemental efforts as needed to appraise future needs for land and water for nonagricultural and non-recreational purposes.
4. An economic appraisal of agricultural water problems, their adverse impact on the economy of the area, and an appraisal of economic benefits that might be derived from their alleviation.
5. Adaptation of available projections of the demand and unit use value of those types of outdoor recreation opportunities adaptable to rural type development in various areas of the basin, based on relative access to population centers and transport costs and other factors.
6. Appraise the economic potentials of rural water and related land resources for recreational use (considering, among other factors, the significance of accessibility with respect to population centers, availability of unemployed human resources, and alternative non-recreational use of the natural resources).
7. To the extent permitted by available appropriate methods and required data, evaluate benefits and economic consequences of alternative plans and schedules of development on (a) satisfaction of demands for outdoor recreation, (b) employment and income opportunities, (c) levels and efficiency of crop and pasture production, (d) levels and efficiency of timber production, and on (e) alleviation of damages from flooding and drought (to the extent feasible, the evaluations would be based on materials developed and provided by SCS, FS, and other agencies participating in the survey).

8. Consider the possibility, if time and resources permit, of a study of alternative patterns and sizes of water resource development (widely dispersed developments versus clusters of development for recreational purposes from the standpoint of efficient organization and management).

Field Advisory Committee

/s/ Howard C. Jackson, Chairman
Soil Conservation Service

/s/ A. C. Richey
Forest Service

March 27, 1963

/s/ Nathan G. Mallett
Economic Research Service

Approval of Washington Advisory Committee in letter from D. A. Williams, Administrator, SCS, dated April 30, 1963, signed by Gladwin E. Young, Acting.

Percent of Total Basin Area in Each County

MERAMEC RIVER BASIN, MISSOURI, 1963

County	Acres of County in Basin	Percent of Total Basin Area Contributed by Each County
Crawford	486,400	19.10
Washington	484,941	19.04
Franklin	381,747	14.99
Dent	289,024	11.35
Jefferson	214,272	8.41
Phelps	177,645	6.97
St. Francois	117,000	4.59
Gasconade	113,408	4.45
St. Louis	99,994	3.93
Iron	78,012	3.06
Maries	72,448	2.84
Ste. Genevieve	21,535	.85
Reynolds	6,194	.24
Osage	1,860	.07
Texas	2,720	.11
TOTAL	2,547,200	100.00

Percent of Total County Area in Each Resource Area

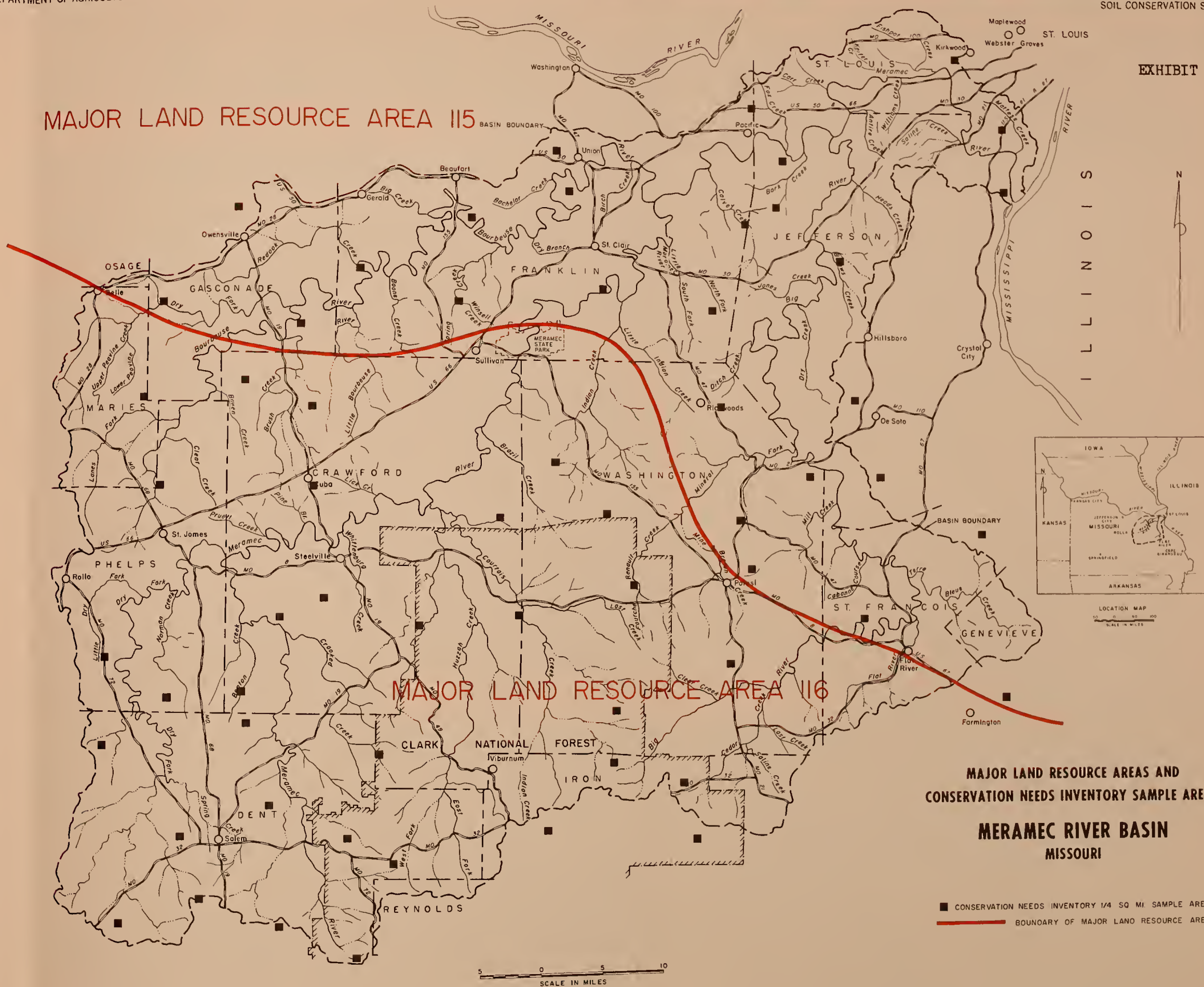
MERAMEC RIVER BASIN, MISSOURI, 1963

County	County Land Area	County in Resource Areas					
		County in Basin			County in Resource Areas		
		(Acres)	(Percent)	(Acres)	Resource Area 115 <u>1/</u>	Resource Area 116 <u>2/</u>	(Percent)
Crawford	486,400	100.00	486,400	-	-	486,400	100.00
Washington	486,400	99.70	484,941	123,213	25.33	361,728	74.37
Franklin	596,480	64.00	381,747	364,185	61.06	17,562	2.94
Dent	483,800	59.74	289,024	-	-	289,024	59.74
Jefferson	426,880	50.19	214,272	214,272	50.19	-	-
Phelps	433,280	41.00	177,645	-	-	177,645	41.00
St. Francois	292,500	40.00	117,000	86,075	29.43	30,925	10.57
Gasconade	332,800	34.07	113,408	88,218	26.50	25,190	7.57
St. Louis	357,120	28.00	99,994	99,994	28.00	-	-
Iron	354,600	22.00	78,012	-	-	78,012	22.00
Maries	336,640	21.52	72,448	2,560	0.76	69,888	20.76
Ste. Genevieve	320,000	6.73	21,535	21,535	6.73	-	-
Reynolds	526,100	1.17	6,194	-	-	6,194	1.17
Osage	384,640	0.48	1,860	1,860	0.48	-	-
Texas	757,120	0.35	2,720	-	-	2,720	0.35
TOTALS			2,547,200	1,001,912		1,545,288	

1/ Central Mississippi Valley Wooded Slopes2/ Ozark Highland

EXHIBIT 4

MAJOR LAND RESOURCE AREA 115



MAJOR LAND RESOURCE AREAS AND
CONSERVATION NEEDS INVENTORY SAMPLE AREAS

MERAMEC RIVER BASIN
MISSOURI

■ CONSERVATION NEEDS INVENTORY 1/4 SQ. MI. SAMPLE AREAS
— BOUNDARY OF MAJOR LAND RESOURCE AREAS

LAND USE
MERAMEC RIVER BASIN
MISSOURI



SOURCE: U.S. Department of Agriculture, Meramec River Preliminary Report (1942).
Basic land-use data compiled from air photos taken about 1940. Later air photos (1955-1959) were used to check basic data and to delineate urban and mining areas.

Estimated Land Use Distribution by Counties
 MERAMEC RIVER BASIN, MISSOURI, 1958

EXHIBIT 6

County	Cropland		Pasture		Woodland		Other	
	Acres	Percent	Acres	Percent	Acres	Percent	Acres	Percent
Crawford	81,545	16.8	57,334	11.8	324,500	66.7	23,020	4.7
Washington	54,260	11.2	58,230	12.0	352,600	72.7	19,851	4.1
Dent	44,111	15.3	29,726	10.3	203,024	70.2	12,163	4.2
Franklin	111,424	29.2	55,569	14.6	190,720	50.0	24,034	6.2
Jefferson	39,855	18.6	42,771	20.0	117,066	54.6	14,580	6.8
Phelps	55,969	31.5	34,627	19.5	72,314	40.7	14,735	8.3
St. Francois	23,960	20.5	25,714	22.0	58,560	50.1	8,766	7.4
Gasconade	46,155	40.7	15,622	13.8	42,400	37.4	9,231	8.1
St. Louis	56,739	56.7	16,790	16.8	21,660	21.7	4,805	4.8
Maries	31,143	43.0	10,541	14.5	24,536	33.9	6,228	8.6
Iron	7,520	9.6	8,070	10.3	59,670	76.6	2,753	3.5
Ste. Genevieve	6,792	31.5	7,289	33.9	4,969	23.0	2,485	11.5
Reynolds	305	4.9	327	5.3	5,451	88.0	111	1.8
Texas	969	35.6	328	12.1	1,230	45.2	193	7.1
Osage	637	34.2	216	11.6	880	47.4	127	6.8
TOTALS	561,384	22.0	363,154	14.0	1,479,580	58.8	143,082	5.2

Source: Interim Report

Estimated Land Use Distribution by Counties, Land Resource
Areas and Basin, MERAMEC RIVER BASIN, MISSOURI, 1958

Resource Area 115

County	Cropland	Pasture	Woodland	Other
- Acres -				
Washington	13,786	14,795	89,595	5,043
Franklin	106,298	53,013	181,947	22,928
Jefferson	39,855	42,771	117,066	14,580
St. Francois	17,626	18,917	43,082	6,449
Gasconade	35,903	12,151	32,982	7,181
St. Louis	56,739	16,790	21,660	4,805
Maries	1,098	371	866	220
Ste. Genevieve	6,792	7,289	4,969	2,485
Osage	637	216	880	127
Total 115	278,734	166,313	493,047	63,818

Resource Area 116

Crawford	81,545	57,334	324,500	23,020
Washington	40,474	43,435	263,005	14,808
Franklin	5,126	2,556	8,773	1,106
Dent	44,111	29,721	203,024	12,163
Phelps	55,969	34,627	72,314	14,735
St. Francois	6,334	6,797	15,478	2,317
Gasconade	10,252	3,471	9,418	2,050
Iron	7,520	8,070	59,670	2,753
Maries	30,045	10,170	23,670	6,008
Reynolds	305	327	5,451	111
Texas	969	328	1,230	193
Total 116	282,650	196,841	986,533	79,264
Basin Total	561,384	363,154	1,479,580	143,082

RECONNAISSANCE LAND CAPABILITY MAP MERAMEC RIVER BASIN MISSOURI



CAPABILITY
CLASS



0 10
SCALE IN MILES

EXHIBIT

SOURCE : U. S. DEPARTMENT OF AGRICULTURE, RECONNAISSANCE SOIL SURVEY MAP, MERAMEC RIVER BASIN, MISSOURI

Percentage of Nonagriculture and Agriculture Employment

For Portions of Counties in the Basin

MERAMEC RIVER BASIN, MISSOURI

County	Total Employed	Total		Percent	
		Nonagr.	Agri.	Nonagr.	Agri.
Crawford	4,456	3,289	1,167	73.8	26.2
Washington	4,177	3,319	858	79.5	20.5
Franklin	7,052	5,391	1,661	76.5	23.5
Dent	2,352	1,625	727	69.0	31.0
Jefferson	8,015	7,341	674	91.6	8.4
Phelps	3,567	3,078	489	86.3	13.7
St. Francois	3,373	2,999	374	88.9	11.1
Gasconade	1,778	1,322	456	74.4	25.6
St. Louis	23,697	23,077	620	97.4	2.6
Iron	577	460	117	79.7	20.3
Maries	625	378	247	60.5	39.5
Ste. Genevieve	282	211	71	74.8	25.2
Reynolds	20	13	7	65.0	35.0
Osage	19	12	7	63.2	36.8
Texas	25	16	9	64.0	36.0
Total	60,015	52,531	7,484	87.5	12.5

Source: U.S. Census of Population - 1960

Forest Industry by Type of Product Manufactured
MERAMEC RIVER BASIN, MISSOURI, 1963

Forest Product	No. of Plants		Annual Production			Plant		Woods ⁵ Full Time	Annual Payroll	Gross Ann. Sales
	Full Time	Part Time	mbf	Cords	M Tons	Full Time	Part Time			
Rough Lumber <u>1/</u>	26	34	60	29,286		140	76	19	\$ 559,600	\$1,335,070
Planed Lumber	0	2	2	175			3	3	2,750	10,750
Flooring	3	0	3	16,000		91		91	235,000	2,250,000
Pallets	5	0	5	4,060		43		43	137,900	401,400
Finished Products <u>2/</u>	4	0	4	2,304		98		98	300,000	840,000
Posts & Poles <u>3/</u>	2	0	2	8,000		21		10	70,000	185,000
Mine Props	1	1	2	700			5	5	8,000	55,000
Lump Charcoal <u>4/</u>	9	4	13		22	48	8	56	114,000	295,280
Charcoal Briquettes <u>4/</u>	2	0	2		60	175		175	500,000	1,800,000
Barrel Staves <u>6/</u>	-	-	-	-	-	-	-	-	-	-
All Industries	52	41	93			616	92	708	\$1,927,250	\$7,172,500

1/ Includes railroad cross-ties, blocking, and some planed lumber.

2/ Includes firms producing ladders, red-cedar products, wicker chairs, and boat trims.

3/ Includes one peeler plant and one preservative treatment plant.

4/ Production and sales information estimated.

5/ Includes only those woods-workers directly employed by the manufacturing concerns. It is estimated that an additional 311 people work in the woods full-time.

6/ There were no stave mills operating at the time of survey.

Gross Returns Attributed to Timber for Growing, Harvesting,
and Processing Timber into Wood Products, and for
Transporting and Selling the Wood Products
MERAMEC RIVER BASIN, MISSOURI, 1963

<u>Group</u>		
Landowners	32,214 mbf. sold @ \$15/mbf.	\$ 483,210
	52,800 cords sold @ \$1/cord	<u>52,800</u>
	Total value harvested	<u>536,010</u>
Log Suppliers <u>1/</u>	52,800 cords sold @ \$6/cord	316,800
	32,214 mbf. sold @ \$20/mbf.	<u>644,280</u>
	Total	<u>961,080</u>
Primary Processors <u>2/</u>	29,286 mbf. sold	1,335,070
	22 M tons sold	<u>295,280</u>
	Total	<u>1,630,350</u>
Secondary Processors <u>3/</u>	22,539 mbf. sold	} Total 5,542,150
	8,770 cords sold	
	30,000 tons sold	
Transporters and Retailers <u>4/</u>	Total Attributed to Timber	<u>3,660,948</u>
	Total Economic Impact Attributable to Timber \$12,330,538	

1/ Includes loggers contracting for a mill, independent operators, farmers and mill men doing their own logging.

2/ Includes rough lumber and lump charcoal producers.

3/ Includes all but rough lumber and charcoal producers.

4/ After Hair, 1963. For each dollar of value harvested in Missouri, \$6.83 in value attributable to timber is added for transportation and marketing.

Soil Groups - By Productivity

MERAMEC RIVER BASIN, MISSOURI

- Group A Deep, well drained, medium textured soils with adequate moisture holding capacity for high yields. Mostly nearly level bottom land areas. Occasional flash overflow may occur. (Capability Unit I. Soils - 66 Huntington silt loam and 55 Wabash silt loam.)
- Group B Deep, well to imperfectly drained soils with moderately fine textured subsoils (silty clay loam). These soils have adequate moisture holding capacity for moderate to high yields but are subject to erosion and somewhat less than well drained. They normally occur on gently to rolling slopes but some areas of such soil occur along the bottom lands. (Capability Units IIe1, IIIe1, IVe1, IIe6, IIIe6, IVe6, IIw1, and IIIw1. Soils 1 and 19 Menfro silt loam, 20 Winfield silt loam, 67 Westerville silt loam.)
- Group C Medium textured soils with well drained subsoils but a problem of droughtiness due to gravelly or cherty layers at 15 to 30 inch depths. These soils are of moderate productivity--occur on nearly level bottom land areas and gentle to rolling upland slopes. (Land Capability Units IIs1, IIIs1, IIe2, IIIe2, and IIIe3; Soils - 92 and 93 Huntington silt loam, 2 moderately deep and shallow phase, 2 Bewleyville silt loam, 3 Baxter cherty silt loam.)
- Group D Moderately deep silty soils over dense, poorly drained claypan or fragipan subsoils. These soils occur on nearly level to rolling slopes, are wet in wet seasons (on flat slopes), droughty in dry seasons and subject to erosion on slopes. Yields are moderate to low. (Capability Units IIIw3, IIIe5, IVe5. Soils - 8 to 23 Dickson silt loam, 9 and 10 Lebanon silt loam and 25 Weston silt loam.)
- Group E Soils with stones or gravel in the surface and throughout the soil, low in available moisture, generally occur on steep slopes but may occur in minor amounts on talus slopes below rocky bluffs. Usually non-arable. (Land Capability Units IVe3, VIe3, VIe6, and VIIe6. Soils 4-5-13 Clarksville cherty and stony silt loam and 91 Ennis gravelly loam, shallow phase.)
- Group F Stream gravel, no productive use. (Capability Unit VIIIs4. Soil 96 - River sand and gravel.)

Land Capability Classification

MERAMEC RIVER BASIN, MISSOURI

Land suitable for many uses:

- Class I - Very good soils that are nearly level, easily worked, have practically no hazards and can be used for cultivated crops safely with ordinary good farming methods.
- Class II - Good soils that are suitable for the use of cultivated crops with extensive (simple, inexpensive, or easily applied) practices to overcome minor hazards such as a slight erosion potential, slight wetness, and slight droughtiness. Soils in this class commonly have gentle slopes.
- Class III - Moderately good soils that can be cultivated safely if supported with intensive practices to overcome one or more major hazards, such as erosion, wetness, or stoniness. Practices or treatments necessary to overcome these limitations are often expensive or complicated to install and to maintain. Some soils in this class are sloping.
- Class IV - Soils only fairly good that usually have hazards so severe that they may be cultivated only with extreme care. The installation and maintenance of the needed practices that would permit cultivation of these soils would have questionable economic feasibility except under favorable local conditions. Therefore, hay or meadow crops which require only occasional cultivation are usually recommended.

Land limited in its use:

- Class V - Nearly level soils that are best suited to permanent vegetation. These soils are too stony, too wet, or too frequently subject to damaging overflow for cultivation.
- Class VI - Soils that are too steeply sloping, too severely eroded, too wet, too stony, or too droughty, alone or in combination, for practical cultivation. Recommended use is usually for grazing or forestry with reasonable care and management. Some soils in this class can be renovated for pasture improvement.

Class VII - Soils that are too steep, too stony, too droughty, too wet, or too eroded, alone or in combination for cultivation. (The hazards exceed those in Class VI.) Recommended use is usually for pasture or timber with extreme care in management. Cultivation is neither safe nor practical with present known methods. Some soils in this class are best protected without use, or with very limited use, in order to conserve water and protect better, lower-lying soils.

Class VIII - Soil areas that are very steep, very stony, very sandy, or very wet. Some such areas consist essentially of rock outcrop. They are best suited for wildlife food and shelter areas or for recreational purposes. Most soils in this class are best protected without use in order to conserve water and protect better, lower-lying soils.

Estimated Land Use Distribution by Soil Groups, Land Resource
Area and Basin, MERAMEC RIVER BASIN, MISSOURI, 1958

Resource Area 115

Soil Group	Cropland	Pasture	Forest	Other	Total
- Acres -					
A	61,767	5,617	20,243	9,071	96,698
B	92,807	57,377	62,948	16,541	229,673
C	14,423	40,525	72,099	11,953	139,000
D	108,483	53,967	42,705	21,451	226,606
E	627	8,827	292,556	4,802	306,812
F	627		2,496		3,123
Total 115	278,734	166,313	493,047	63,818	1,001,912

Resource Area 116

A	39,657	13,925	4,410	1,854	59,846
B	46,147	4,248	8,561	3,245	62,201
C	67,057	72,930	95,463	19,005	254,455
D	118,252	62,783	151,495	40,327	372,856
E	11,537	42,956	723,750	14,833	793,076
F			2,854		2,854
Total 116	282,650	196,841	986,533	79,264	1,545,288

Basin

A	101,424	19,542	24,653	10,925	156,544
B	138,954	61,625	71,509	19,786	291,874
C	81,480	113,455	167,562	30,958	393,455
D	226,735	116,749	194,200	61,778	599,462
E	12,164	51,783	1,016,306	19,635	1,099,888
F	627		5,350		5,977
Basin Total	561,384	363,154	1,479,580	143,082	2,547,200

Normalized Yields of Crops and Pasture, by Land Resource Area

MERAMEC RIVER BASIN, MISSOURI, 1958

Resource Area 115

Soil Group	Corn (bu)	Wheat (bu)	Oats (bu)	Soybeans (bu)	Sorghum (bu)	Hay (ton)	Cropland Pasture (lbs. of beef per acre)
A	56.5	34.9	39.6	24.8	58.2	1.96	250
B	47.8	30.0	34.6	19.8	47.6	1.57	200
C	39.1	25.0	29.7	14.9	42.3	1.18	150
D	30.4	20.0	24.7	-	31.7	1.57	150
E	17.4	15.0	19.8	-	-	.79	100
F	-	-	-	-	-	-	-

Resource Area 116

A	50.3	30.7	37.7	22.6	52.9	1.96	250
B	42.5	26.3	33.0	18.1	43.2	1.57	200
C	34.8	21.9	28.3	13.6	38.4	1.17	150
D	27.1	17.5	23.6	-	28.8	1.57	150
E	15.5	13.2	18.9	-	-	.78	100
F	-	-	-	-	-	-	-

Normalized Acreage of Cropland Use by Soil Groups, by Land Resource

Areas and Basin, MERAMEC RIVER BASIN, MISSOURI, 1958

Resource Area 115

Soil Group	Corn	Wheat	Oats	Soybeans	Sorghum	Hay	Cropland Pastured	Not Harvested	Total
				- Acres -					
A	30,000	2,480	440	3,700	200	8,200	8,600	8,147	61,767
B	8,000	9,800	2,700	950	350	20,000	34,000	17,007	92,807
C	3,000	1,740	860	450	136	4,500	2,000	1,737	14,423
D	10,000	9,680	1,800	-	314	17,100	45,223	24,366	108,483
E	-	100	100	-	-	-	227	200	627
F	-	-	-	-	-	-	-	627	627
Total 115	51,000	23,800	5,900	5,100	1,000	49,800	90,050	52,084 1/2	278,734

Resource Area 116

A	15,000	900	300	250	220	5,847	11,439	5,701	39,657
B	1,200	1,200	700	100	100	14,800	20,047	8,000	46,147
C	2,800	1,750	1,000	150	230	18,127	31,000	12,000	67,057
D	7,000	2,250	1,500	-	250	20,426	53,839	32,987	118,252
E	-	150	-	-	-	3,000	5,000	3,387	11,537
F	-	-	-	-	-	-	-	-	-
Total 116	26,000	6,250	3,500	500	800	62,200	121,325	62,075 1/2	282,650
Basin Total	77,000	30,050	9,400	5,600	1,800	112,000	211,375	114,159	561,384

1/ Estimate

Normalized Acres, Yield, and Production

MERAMEC RIVER BASIN, MISSOURI, 1958

Area	Acres	Yield (bu)	Production
<u>Corn</u>			
115	51,000	49.0	2,498,700
116	<u>26,000</u>	42.0	<u>1,092,640</u>
Basin	77,000	46.6	3,591,340
<u>Wheat</u>			
115	23,800	26.0	619,152
116	<u>6,250</u>	22.2	<u>138,870</u>
Basin	30,050	25.2	758,022
<u>Oats</u>			
115	5,900	31.0	182,826
116	<u>3,500</u>	28.0	<u>98,110</u>
Basin	9,400	29.9	280,936
<u>Soybeans</u>			
115	5,100	23.0	117,275
116	<u>500</u>	19.0	<u>9,500</u>
Basin	5,600	22.6	126,775
<u>Sorghum</u>			
115	1,000	44.0	44,007
116	<u>800</u>	40.0	<u>31,990</u>
Basin	1,800	42.2	75,997
<u>All Hay</u>			
115	49,800	1.60 Tons	79,629 Tons
116	<u>62,200</u>	1.45	<u>90,313</u>
Basin	112,000	1.52	169,942
Total 115	136,600		
Total 116	<u>99,250</u>		
Total Basin	235,850		

Normalized Production of Crops by Soil Groups, Land Resource Areas,
and Basin, MERAMEC RIVER BASIN, MISSOURI, 1958

Resource Area 115

Soil Group	Corn (bu)	Wheat (bu)	Oats (bu)	Soybeans (bu)	Sorghum (bu)	Hay (tons)	Cropland Pasture (lbs. of beef)
A	1,695,000	86,552	17,424	91,760	11,640	16,072	2,150,000
B	382,400	294,000	93,420	18,810	16,660	31,400	400,000
C	117,300	43,500	25,542	6,705	5,753	5,310	3,400,000
D	304,000	193,600	44,460	-	9,954	26,847	6,750,000
E	-	1,500	1,980	-	-	-	22,700
F	-	-	-	-	-	-	-
Total 115	2,498,700	619,152	182,826	117,275	44,007	79,629	12,722,700

Resource Area 116

A	754,500	27,630	11,310	5,650	11,638	11,460	2,859,750
B	51,000	31,560	23,100	1,810	4,320	23,236	6,200,000
C	97,440	38,325	28,300	2,040	8,832	21,208	3,007,050
D	189,700	39,375	35,400	-	7,200	32,069	8,075,850
E	-	1,980	-	-	-	2,340	500,000
F	-	-	-	-	-	-	-
Total 116	1,092,650	138,870	98,110	9,500	31,990	90,313	20,642,650
Basin Total	3,591,340	758,022	280,936	126,775	75,997	169,942	33,365,350

Acres, Yield, Production, and Value of Crop Production

MERAMEC RIVER BASIN, MISSOURI, 1959

Commodity	Acreage	Yield	Production	Seasonal Average Price	Value of Crops
				(Dollars)	(Dollars)
<u>Resource Area 115</u>					
Corn	53,923	45.9 bu.	2,475,237 bu.	1.05	\$2,598,999
Wheat	23,282	24.1 bu.	560,823 bu.	1.72	964,616
Oats	6,012	30.1 bu.	181,098 bu.	.67	121,336
Soybeans	4,399	19.9 bu.	87,335 bu.	1.95	170,303
Sorghum	1,332	39.5 bu.	52,627 bu.	.82	43,154
All Hay	40,084	1.43 tons	57,250 tons	18.50	1,059,125
Total 115					\$4,957,533
<u>Resource Area 116</u>					
Corn	28,838	38.5 bu.	1,111,314 bu.	1.05	\$1,166,880
Wheat	6,213	18.2 bu.	113,355 bu.	1.72	194,970
Oats	3,367	26.6 bu.	89,708 bu.	.67	60,104
Soybeans	770	17.6 bu.	13,516 bu.	1.95	26,356
Sorghum	1,028	28.8 bu.	52,627 bu.	.82	43,154
All Hay	56,045	1.17 tons	65,294 tons	18.50	1,207,940
Total 116					\$2,699,404
<u>Meramec River Basin</u>					
Corn	82,761	43.3 bu.	3,586,551 bu.	1.05	\$3,765,879
Wheat	29,495	22.9 bu.	674,178 bu.	1.72	1,159,586
Oats	9,379	28.9 bu.	270,806 bu.	.67	181,440
Soybeans	5,169	19.5 bu.	100,851 bu.	1.95	196,659
Sorghum	2,360	34.9 bu.	82,248 bu.	.82	86,308
All Hay	96,129	1.27 tons	122,544 tons	18.50	2,267,065
Total Basin					\$7,656,937

Source: U.S. Census of Agriculture, 1959

Production and Value of Livestock and Livestock Products

MERAMEC RIVER BASIN, MISSOURI, 1959

Commodity	Units	Production	Value
<u>Resource Area 115</u>			
Livestock Products			
Cattle & calves	Number	29,451	\$ 3,825,991
Hogs & pigs	Number	82,195	2,465,869
Sheep & lambs	Number	3,429	51,420
Dairy Products			
Whole milk	Pounds	40,974,700	
Butterfat	Pounds	253,001	1,712,385 ^{1/}
Chickens ^{3/}	Number	686,952	
Eggs	Dozen	2,550,887	1,274,019 ^{2/}
Turkeys	Number	57,228	259,768
Total 115			\$ 9,589,452

Resource Area 116

Livestock Products			
Cattle & calves	Number	41,084	\$ 5,197,962
Hogs & pigs	Number	63,167	1,895,032
Sheep & lambs	Number	2,692	40,376
Dairy Products			
Whole milk	Pounds	19,318,832	
Butterfat	Pounds	127,149	818,477
Chickens	Number	319,309	
Eggs	Dozen	1,077,838	673,156
Turkeys	Number	38,237	173,310
Total 116			\$ 8,798,313

Meramec River Basin

Livestock Products			
Cattle & calves	Number	70,535	\$ 9,023,953
Hogs & pigs	Number	145,362	4,360,901
Sheep & lambs	Number	6,121	91,796
Dairy Products			
Whole milk	Pounds	60,293,532	
Butterfat	Pounds	380,150	2,530,862
Chickens	Number	1,006,261	
Eggs	Dozen	3,628,725	1,947,175
Turkeys	Number	95,465	433,078
Total Basin			\$18,387,765

^{1/} Includes whole milk and butterfat^{2/} Includes all chickens and eggs^{3/} Includes chicken, broilers, and other chickens

Rank of Counties According to Their Relative Gross Productivity
Per Acre of Land, MERAMEC RIVER BASIN, MISSOURI, 1950

County	Relative Gross Productivity	State Rank	Basin Rank
St. Louis	61.85	31	1
Franklin	45.24	76	2
Gasconade	43.06	77	3
Ste. Genevieve	41.71	79	4
St. Francois	40.26	80	5
Jefferson	39.30	82	6
Osage	38.07	86	7
Maries	33.14	93	8
Washington	32.38	95	9
Dent	30.98	100	10
Phelps	30.80	101	11
Texas	29.85	103	12
Crawford	29.82	104	13
Iron	28.85	105	14
Reynolds	25.84	114	15

Source: Lanpher, Buel F. Jr.

Productivity of Farm Land in Missouri

Missouri Agricultural Experiment Station Research

Bulletin 465, p. 23. 1950

Forest Land Area in the Meramec Basin by Stand Size Class
and Resource Area 1/, MERAMEC RIVER BASIN, MISSOURI

Resource Area	Stand Size Class			All Size Classes
	Sawtimber	Poletimber	Reproduction- Saplings	
- Acres -				
115	103,582	216,830	172,638	493,050
116	<u>246,319</u>	<u>395,519</u>	<u>344,692</u>	<u>986,530</u>
Basin	349,901	612,349	517,330	1,479,580

1/ From data in: Mendel (1961) and U.S. Forest Service (1961)

Net Timber Volume on Commercial Forest Land by Resource Area,
Species Group, and Size Class 1/, MERAMEC RIVER BASIN, MISSOURI

Species Group	Resource Area				Resource Area				Total Basin	
	115				116					
	Sawtimber	Growing Stock	Culls	Hardwood Limbs	Sawtimber	Growing Stock	Culls	Hardwood Limbs	Sawtimber	Growing Stock
	Board-Ft. (million)	Cords (thousand)	Cords (thousand)	Cords	Board-Ft. (million)	Cords (thousand)	Cords (thousand)	Cords	Board-Ft. (million)	Cords (thousand)
Hard Hardwoods	434.1	2,045.7	395.5	851.7	544.2	3,788.7	644.5	1,067.9	978.3	5,834.4
Soft Hardwoods	25.0	90.8	43.0	11.7	24.5	147.9	49.1	45.3	49.5	238.7
All Hardwoods	459.1	2,136.5	438.5	863.4	568.7	3,936.6	693.6	1,113.2	1,027.8	6,073.1
Softwoods	14.7	101.7	5.8		77.8	489.5	20.1		92.5	591.2
All Species	473.8	2,238.2	444.3	863.4	646.5	4,426.1	713.7	1,113.2	1,120.3	6,664.3

1/ Developed from data in Mendel (1961) and U.S. Forest Service (1961).

Forest Land Area by Site Productivity Class 1/
 MERAMEC RIVER BASIN, MISSOURI

Productivity (site) Class <u>2/</u>	Percent of Total Area	Number of Acres
Poor (50 site index)	1	14,796
Fair (50-60 site index)	19	281,120
Medium (60-70 site index)	61	902,544
Good (70-80 site index)	18	266,324
Excellent (80+ site index)	<u>1</u>	<u>14,796</u>
All Classes	100	1,479,580

1/ Modified from: Smith (1961)

2/ Site index is the height of the average dominant and codominant tree in a stand at 50 years of age.

Utilization by the Basin Population of the Major Farm

Products Produced - 1980 and 2010

MERAMEC RIVER BASIN, MISSOURI

Commodity	Unit	1980 (millions)	2010 (millions)
Meat Animals			
Beef and veal	Pound	75.31	167.79
Lamb and mutton	Pound	2.69	5.95
Pork	Pound	38.14	83.05
Dairy Products			
Milk equivalent	Pound	227.57	491.39
Poultry			
Chicken	Pound	18.10	42.50
Turkey	Pound	5.42	11.73
Eggs	Number	120.39	261.63
Crops (Non-feed)			
Wheat	Pound	142.74	255.00
Soybeans	Pound	129.87	257.04
Vegetables	Pound	92.27	200.06
Potatoes	Pound	61.62	134.30

Feed Unit Needs of Basin Population

MERAMEC RIVER BASIN, MISSOURI

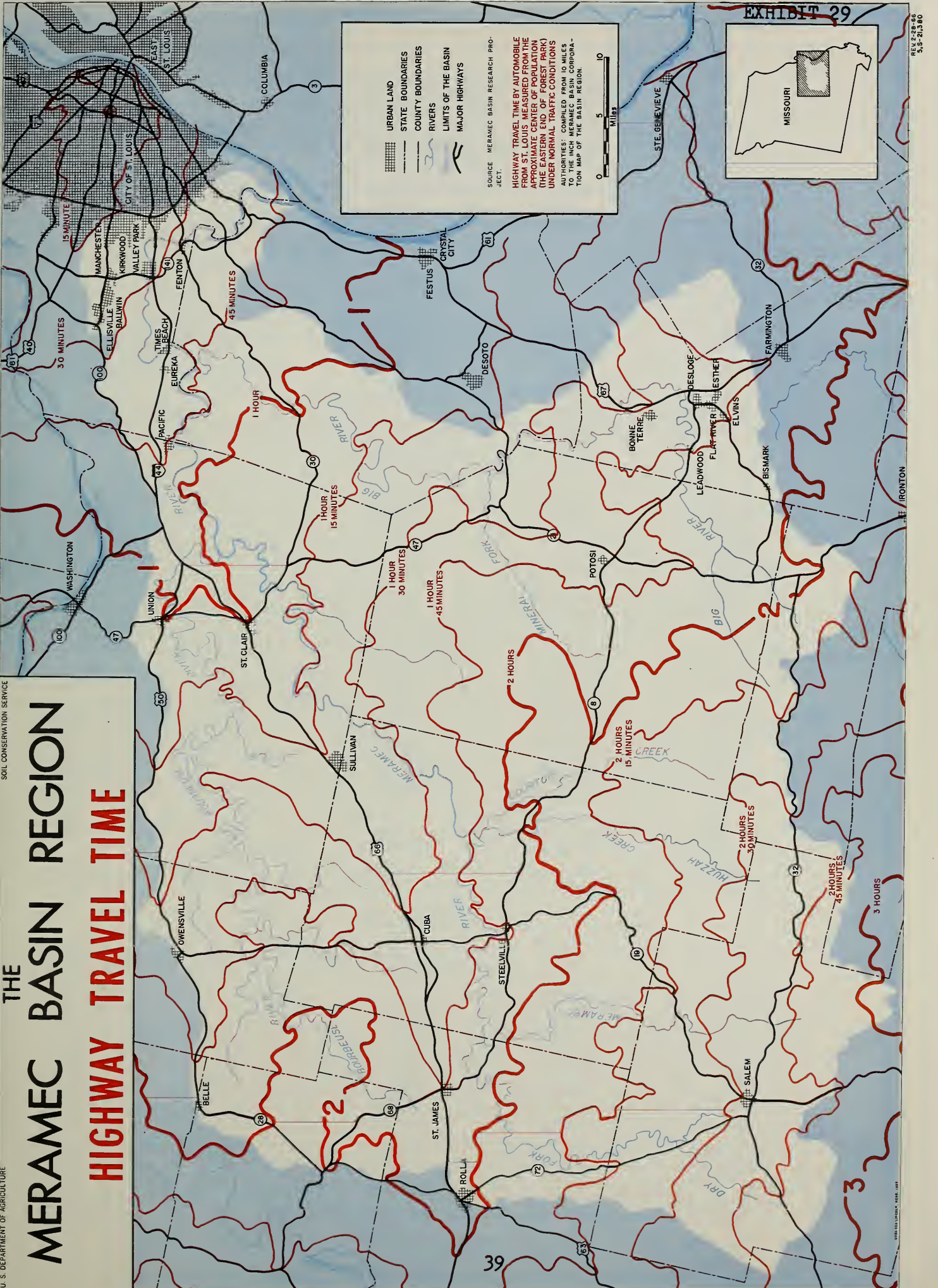
Commodity	1980	2010
	Feed Units (Millions)	Feed Units (Millions)
Meat Animals		
Beef and veal	790.76	1,342.32
Lamb and mutton	32.38	53.55
Pork	152.56	290.68
Dairy Products		
Milk equivalent	193.43	343.97
Poultry		
Chicken	45.25	93.50
Turkey	17.34	31.67
Eggs	54.18	117.73
Total	1,285.80	2,273.42

Potential Feed Units with Project Installation
1980 and 2010, MERAMEC RIVER BASIN, MISSOURI

Commodity	1980	2010
	Feed Units (Millions)	Feed Units (Millions)
Corn	1,553	2,808
Wheat	391	836
Hay	450	614
Pasture	<u>817</u>	<u>490</u>
Total	3,211	4,748

Potential Acres of Cropland with Maximum Use without
Deterioration, MERAMEC RIVER BASIN, MISSOURI

Land Resource Area	Row Crop	Small Grain	Meadow	Total Cropland
- Acres -				
115	196,921	75,835	89,724	362,480
116	<u>178,901</u>	<u>80,551</u>	<u>123,199</u>	<u>382,651</u>
Total Basin	375,822	156,386	212,923	745,131



THE MERAMEC BASIN REGION

HIGHWAY TRAVEL TIME

URBAN LAND

STATE BOUNDARIES

COUNTY BOUNDARIES

RIVERS

LIMITS OF THE BASIN

MAJOR HIGHWAYS

SOURCE: MERAMEC BASIN RESEARCH PROJECT.

HIGHWAY TRAVEL TIME BY AUTOMOBILE FROM ST. LOUIS MEASURED FROM THE APPROXIMATE CENTER OF POPULATION (THE EASTERN END OF FOREST PARK) UNDER NORMAL TRAFFIC CONDITIONS

AUTHORITIES: COMPILED FROM 10 MILES TO 100 MILES RADIUS CONCORDANCE MAP OF THE BASIN REGION.

0

5

10

Miles

EXHIBIT 29

MISSOURI

Present and Projected Population by Time Zones
(for the Basin Plus 30 Mile Perimeter)

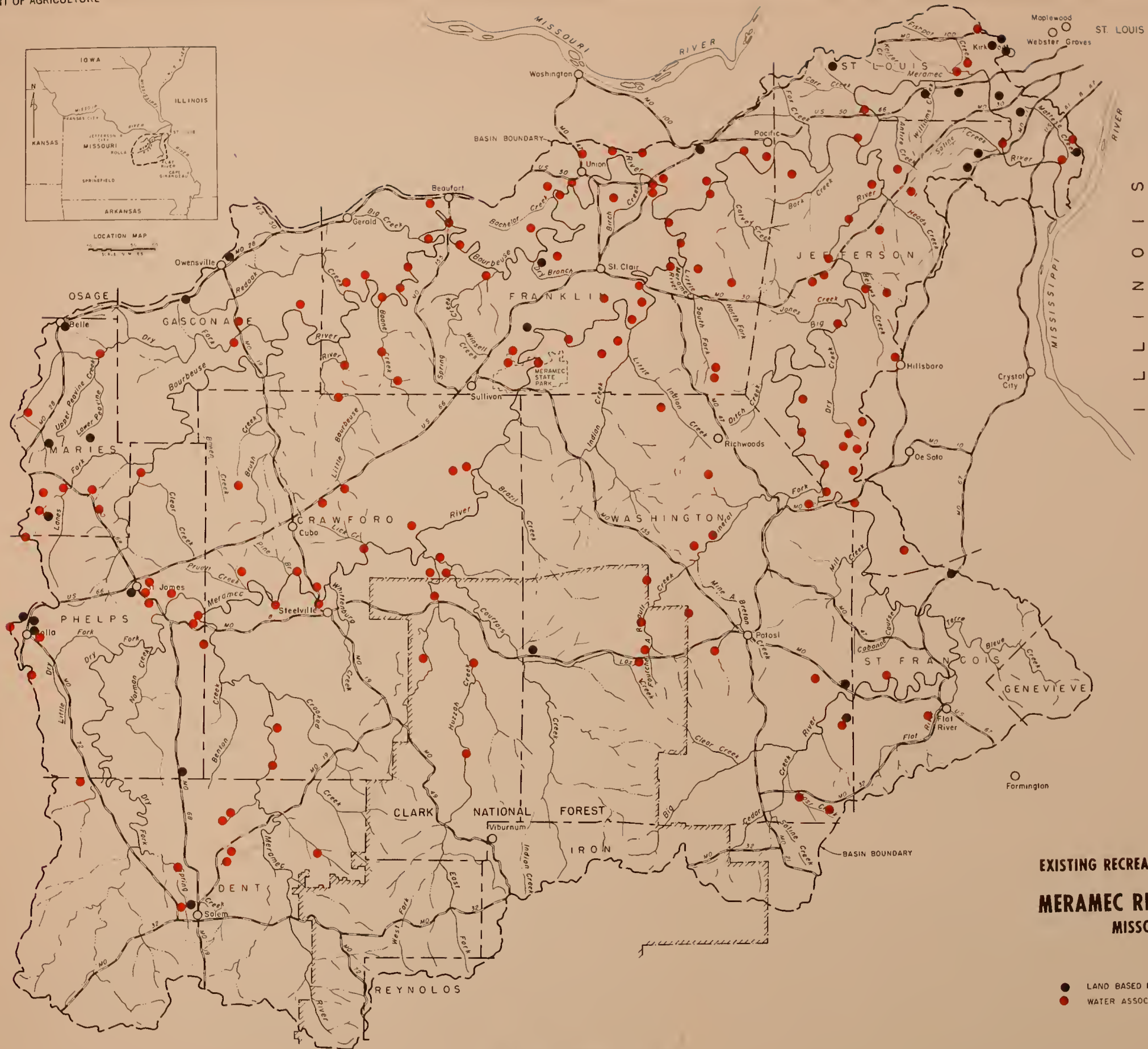
MERAMEC RIVER BASIN, MISSOURI

County	1960 (thousands)	1980 (thousands)	2010 (thousands)
<u>1 Hour</u>			
St. Louis City	1,000.0	1,000.0	1,000.0
St. Louis County	700.0	1,100.0	1,700.0
Jefferson	26.4	74.4	146.4
Franklin	17.0	39.6	70.0
Total 1 Hour	1,743.4	2,214.0	2,916.4
<u>1-1½ Hours</u>			
Jefferson	39.6	111.6	219.6
Franklin	25.0	43.2	79.0
Washington	1.0	1.2	2.5
Crawford	1.5	3.5	6.0
Total 1-1½ Hours	67.1	161.5	307.1
<u>1½-2 Hours</u>			
Gasconade	11.2	14.5	20.0
Franklin	2.0	2.1	2.5
Washington	10.0	16.3	23.6
St. Francois	32.0	33.2	36.7
Crawford	8.5	16.5	30.0
Phelps	18.0	29.0	46.0
Maries	1.4	1.7	2.0
Total 1½-2 Hours	83.1	113.3	160.8
Total 1-2 Hours	150.2	274.8	467.9
<u>2+ Hours</u>			
Dent	10.3	19.0	28.8
Washington	3.1	4.6	8.0
Iron	9.5	13.5	23.0
Crawford	2.5	3.8	4.5
Gasconade	1.0	1.3	2.0
Phelps	7.0	7.7	9.0
Maries	5.9	6.9	8.8
Reynolds (50%)	2.5	3.7	5.7
St. Francois	4.0	4.1	4.3
Total 2-3 Hours	45.8	64.6	94.1
TOTAL	1,939.4	2,553.4	3,478.4

Recreation Demand by Time Zones
MERAMEC RIVER BASIN, MISSOURI, 1960

Activity	Recreation Days
<u>1st hour time zone</u>	Population 1,743,400
Boating	467,928
Water Skiing	31,381
Swimming	4,040,330
Fishing	1,006,116
Camping	64,157
Picnicking	3,630,979
Sight Seeing & Nature Walks, etc.	435,850
Hunting	389,127
	<u>10,065,868</u>
<u>1 to 1½ hour time zone</u>	Population 67,100
Boating	18,010
Water Skiing	1,208
Swimming	155,504
Fishing	38,723
Camping	2,469
Picnicking	139,749
Sight Seeing & Nature Walks, etc.	16,775
Hunting	14,977
	<u>387,415</u>
<u>1½ to 2 hour time zone</u>	Population 83,100
Boating	22,304
Water Skiing	1,495
Swimming	192,582
Fishing	47,957
Camping	3,058
Picnicking	173,072
Sight Seeing & Nature Walks, etc.	20,775
Hunting	18,548
	<u>479,791</u>
<u>2+ hour time zone</u>	Population 45,800
Boating	12,293
Water Skiing	824
Swimming	106,142
Fishing	26,431
Camping	1,685
Picnicking	95,388
Sight Seeing & Nature Walks, etc.	11,450
Hunting	10,222
	<u>264,435</u>
TOTAL	<u>11,197,509</u>

EXHIBIT 32



EXISTING RECREATIONAL AREAS
MERAMEC RIVER BASIN
MISSOURI

- LAND BASED RECREATION
- WATER ASSOCIATED RECREATION

Projected Harvested Acres, Yield, and Production Without
Project Installed, MERAMEC RIVER BASIN, MISSOURI, 1980

Area	Acres	Yield (bu.)	Production (bu.)
CORN			
115	44,000	75.0	3,300,000
116	<u>22,000</u>	65.0	<u>1,430,000</u>
Basin	66,000	71.7	4,730,000
WHEAT			
115	22,000	36.0	792,000
116	<u>7,000</u>	34.0	<u>238,000</u>
Basin	29,000	35.5	1,030,000
OATS			
115	3,000	44.0	132,000
116	<u>2,000</u>	40.0	<u>80,000</u>
Basin	5,000	42.4	212,000
SOYBEANS			
115	12,000	32.0	384,000
116	<u>700</u>	30.0	<u>21,000</u>
Basin	12,700	31.9	405,000
SORGHUM			
115	1,500	60.0	90,000
116	<u>1,200</u>	55.0	<u>66,000</u>
Basin	2,700	57.8	156,000
ALL HAY			
115	43,000	2.2 Ton	94,600
116	<u>55,000</u>	1.9	<u>104,500</u>
Basin	<u>98,000</u>	2.03 Ton	199,100
Total 115	125,500		
Total 116	<u>87,900</u>		
Total Basin	213,400		

Projected Harvested Acres, Yield, and Production With Project
Installed, MERAMEC RIVER BASIN, MISSOURI, 1980

Area	Acres	Yield (bu.)	Production (bu.)
CORN			
115	44,000	82.3	3,621,200
116	22,000	72.5	1,595,000
Basin	66,000	79.0	5,216,200
WHEAT			
115	22,000	40.3	886,600
116	7,000	37.9	265,300
Basin	29,000	39.7	1,151,900
OATS			
115	3,000	48.0	144,000
116	2,000	43.2	86,400
Basin	5,000	46.1	230,400
SOYBEANS			
115	12,000	37.0	444,000
116	700	35.0	24,500
Basin	12,700	36.9	468,500
SORGHUM			
115	1,500	64.3	96,450
116	1,200	59.2	71,040
Basin	2,700	62.0	167,490
ALL HAY			
115	43,000	2.8 Ton	120,400
116	55,000	2.4	132,000
Basin	98,000	2.58 Ton	252,400
Total 115	125,500		
Total 116	87,900		
Total Basin	213,400		

Projected Harvested Acres, Yield, and Production With Project
Installed, MERAMEC RIVER BASIN, MISSOURI, 2010

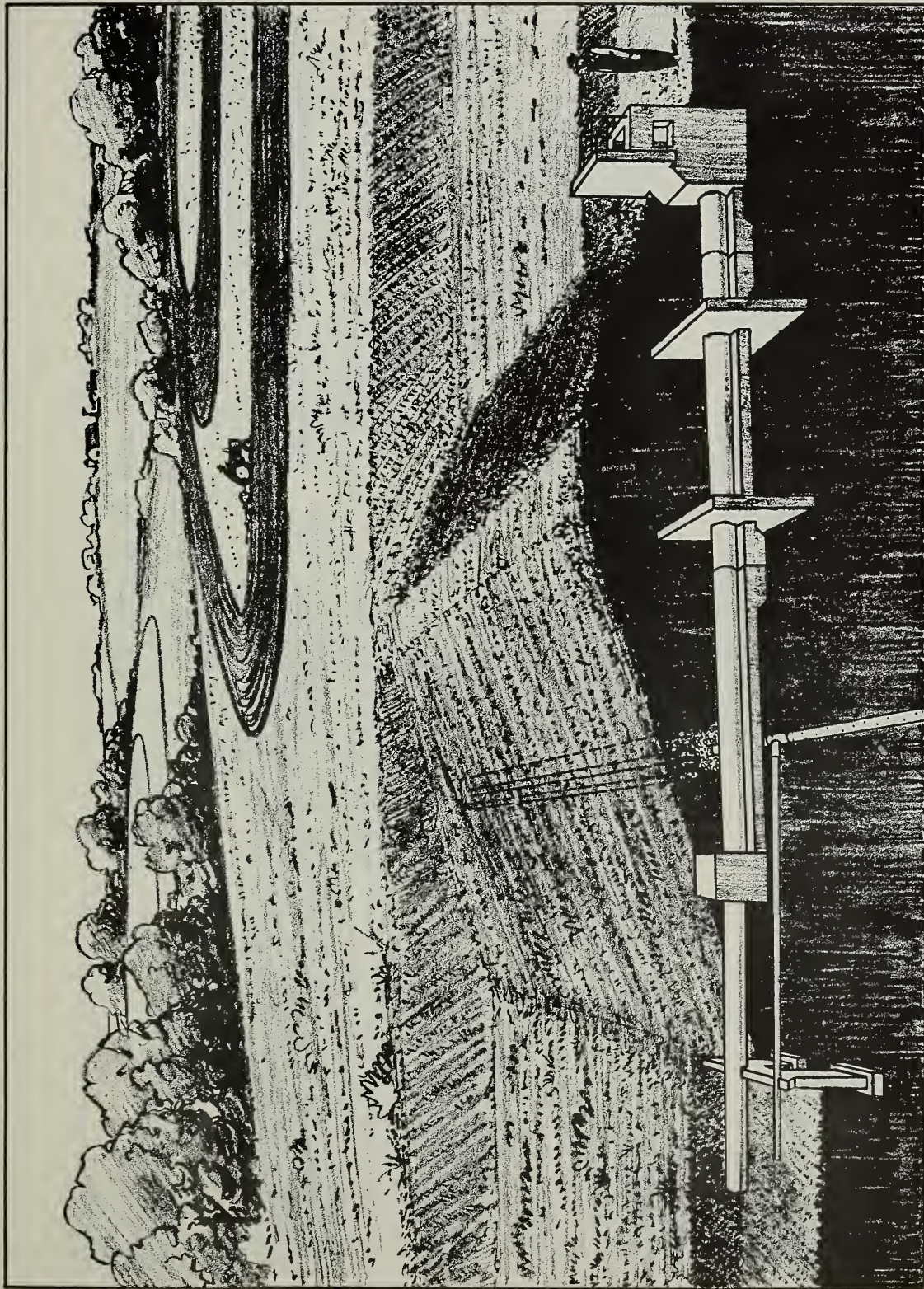
Area	Acres	Yield (bu.)	Production (bu.)
CORN			
115	52,000	101.9	5,298,800
116	<u>26,000</u>	92.5	<u>2,405,000</u>
Basin	78,000	98.8	7,703,800
WHEAT			
115	24,000	56.8	1,363,200
116	<u>7,000</u>	53.7	<u>375,900</u>
Basin	31,000	56.1	1,739,100
OATS			
115	3,000	56.0	168,000
116	<u>2,000</u>	49.7	<u>99,400</u>
Basin	5,000	53.5	267,400
SOYBEANS			
115	18,000	47.0	846,000
116	<u>1,000</u>	45.0	<u>45,000</u>
Basin	19,000	46.9	891,000
SORGHUM			
115	3,000	73.0	219,000
116	<u>2,400</u>	67.5	<u>162,000</u>
Basin	5,400	70.5	381,000
ALL HAY			
115	50,000	4.0 Ton	200,000
116	<u>62,000</u>	3.4	<u>210,800</u>
Basin	<u>112,000</u>	3.67 Ton	410,800
Total 115	150,000		
Total 116	<u>100,400</u>		
Total Basin	250,400		

Recreation Demand by Time Zones
MERAMEC RIVER BASIN, MISSOURI, 1980

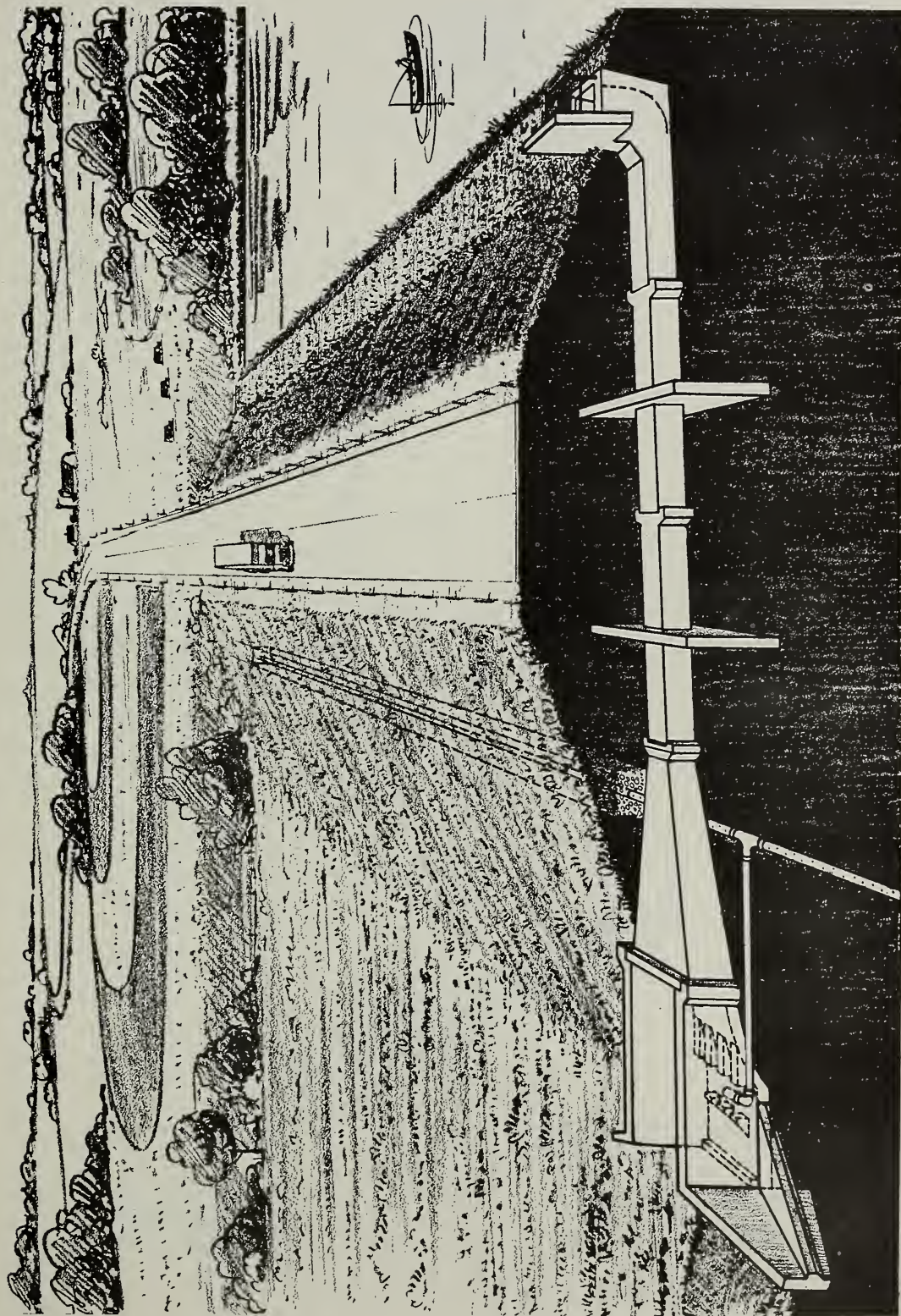
Activity	Recreation Days
1st hour time zone	Population 2,214,000
Boating	1,164,015
Water Skiing	94,307
Swimming	9,752,888
Fishing	1,720,564
Camping	203,669
Picnicking	7,706,232
Sight-seeing & Nature Walks, etc.	1,007,278
Hunting	661,483
	<u>22,310,436</u>
1 to 1½ hour time zone	Population 161,500
Boating	84,895
Water Skiing	6,878
Swimming	711,312
Fishing	125,487
Camping	562,042
Picnicking	14,854
Sight-seeing & Nature Walks, etc.	73,464
Hunting	48,244
	<u>1,627,176</u>
1½ to 2 hour time zone	Population 113,300
Boating	59,570
Water Skiing	4,827
Swimming	499,111
Fishing	88,051
Camping	10,423
Picnicking	394,372
Sight-seeing & Nature Walks, etc.	51,482
Hunting	33,852
	<u>1,141,688</u>
2+ hour time zone	Population 64,600
Boating	33,967
Water Skiing	2,752
Swimming	284,604
Fishing	31,474
Camping	5,944
Picnicking	224,880
Sight-seeing & Nature Walks, etc.	29,395
Hunting	19,303
	<u>632,319</u>
Total Recreation Days	25,711,619

Recreation Demand by Time Zones
MERAMEC RIVER BASIN, MISSOURI, 2010

Activity	Recreation Days
1st hour time zone	Population 2,916,400
Boating	3,265,785
Water Skiing	302,722
Swimming	27,035,028
Fishing	3,366,109
Camping	692,937
Sight-seeing & Nature Walks, etc.	2,777,871
Hunting	1,242,386
Picnicking	18,772,575
	<u>57,455,413</u>
1 to 1½ hour time zone	Population 307,100
Boating	343,890
Water Skiing	31,877
Swimming	2,846,817
Fishing	354,455
Camping	72,967
Picnicking	1,976,772
Sight-seeing & Nature Walks, etc.	292,513
Hunting	130,825
	<u>6,050,116</u>
1½ to 2 hour time zone	Population 160,800
Boating	180,064
Water Skiing	16,691
Swimming	1,490,616
Fishing	185,595
Camping	38,206
Picnicking	1,035,054
Sight-seeing & Nature Walks, etc.	153,162
Hunting	68,500
	<u>3,167,888</u>
2+ hour time zone	Population 94,100
Boating	105,373
Water Skiing	9,768
Swimming	872,307
Fishing	108,610
Camping	22,358
Picnicking	605,712
Sight-seeing & Nature Walks, etc.	89,630
Hunting	40,087
	<u>1,853,845</u>
Total Recreation Days	68,527,262



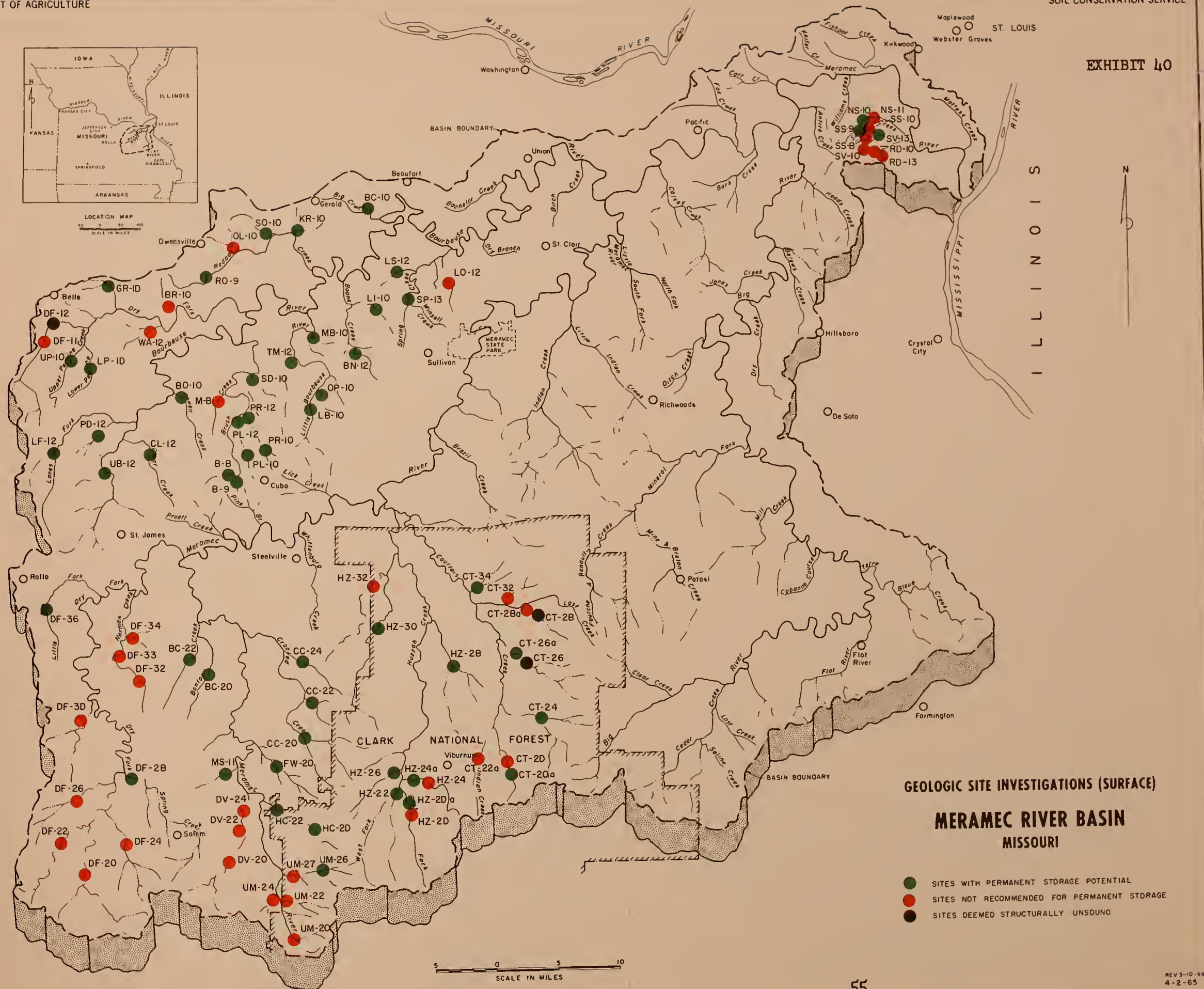
Dry basin type earthfill dam with two-stage inlet.



Monolithic drop-inlet on roadway and conservation pool with recreation and wildlife.



EXHIBIT 40



WATERSHED PROTECTION AND FLOOD PREVENTION ACT. AS AMENDED*

AN ACT

To authorize the Secretary of Agriculture to cooperate with States and local agencies in the planning and carrying out of works of improvement for soil conservation, and for other purposes.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That erosion, floodwater, and sediment damages in the watersheds of the rivers and streams of the United States, causing loss of life and damage to property, constitute a menace to the national welfare; and that it is the sense of Congress that the Federal Government should cooperate with States and their political subdivisions, soil or water conservation districts, flood prevention or control districts, and other local public agencies for the purpose of preventing such damages and of furthering the conservation, development, utilization, and disposal of water and thereby of preserving and protecting the Nation's land and water resources.

SEC. 2. For the purposes of this Act, the following terms shall mean:

The "Secretary" --the Secretary of Agriculture of the United States.

"Works of improvement" --any undertaking for--

(1) flood prevention (including structural and land-treatment measures) or

(2) the conservation, development, utilization, and disposal of water

in watershed or subwatershed areas not exceeding two hundred and fifty thousand acres and not including any single structure which provides more than twelve thousand five hundred acre-feet of floodwater detention capacity, and more than twenty-five thousand acre-feet of total capacity. No appropriation shall be made for any plan involving an estimated Federal contribution to construction costs in excess of \$250,000, or which includes any structure which provides more than twenty-five hundred acre-feet of total capacity unless such plan has been approved by resolutions adopted by the appropriate committees of the Senate and House of Representatives: Provided, That in the case of any plan involving no single structure providing more than 4,000 acre-feet of total capacity the appropriate committees shall be the Committee on Agriculture and Forestry of the Senate and the Committee on Agriculture of the House of Representatives and in the case of any plan involving any single structure of more than 4,000 acre-feet of total capacity the appropriate committees shall be the Committee on Public Works of the Senate and the Committee on Public Works of the House of Representatives, respectively. A number of such subwatersheds when they are component parts of a larger watershed may be planned together when the local sponsoring organizations so desire.

"Local organization" --any State, political subdivision thereof, soil or water conservation district, flood prevention or control district, or combination thereof, or any other agency having authority under State law to carry out, maintain and operate the works of improvement; or any irrigation or reservoir company, water users' association, or similar organization having such authority and not being operated for profit that may

 *(P.L. 566, 83d Cong., 68 Stat. 666; P.L. 1018, 84th Cong., 70 Stat. 1088; P.L. 85-624, 85th Cong., 72 Stat. 563; P.L. 85-865, 85th Cong., 72 Stat. 1605; P.L. 86-468, 86th Cong., 74 Stat. 131, 132; P.L. 86-545, 86th Cong., 74 Stat. 254; P.L. 87-170, 87th Cong., 75 Stat. 408; P.L. 87-703, 87th Cong., 76 Stat. 608; P.L. 89-337, 89th Cong., 66 Stat. 666.)

be approved by the Secretary.

SEC. 3. In order to assist local organizations in preparing and carrying out plans for works of improvement, the Secretary is authorized, upon application of local organizations if such application has been submitted to, and not disapproved within 45 days by, the State agency having supervisory responsibility over programs provided for in this Act, or by the Governor if there is no State agency having such responsibility--

(1) to conduct such investigations and surveys as may be necessary to prepare plans for works of improvement;

(2) to prepare plans and estimates required for adequate engineering evaluation;

(3) to make allocations of costs to the various purposes to show the basis of such allocations and to determine whether benefits exceed costs;

(4) to cooperate and enter into agreements with and to furnish financial and other assistance to local organizations: Provided, That, for the land-treatment measures, the Federal assistance shall not exceed the rate of assistance for similar practices under existing national programs;

(5) to obtain the cooperation and assistance of other Federal agencies in carrying out the purposes of this section.

SEC. 4. The Secretary shall require as a condition to providing Federal assistance for the installation of works of improvement that local organizations shall--

(1) acquire, or with respect to interests in land to be acquired by condemnation provide assurances satisfactory to the Secretary that they will acquire, without cost to the Federal Government, such land, easements, or rights-of-way as will be needed in connection with works of improvement installed with Federal assistance: Provided, That when a local organization agrees to operate and maintain any reservoir or other area included in a plan for public fish and wildlife or recreational development, the Secretary shall be authorized to bear not to exceed one-half of the costs of (a) the land, easements, or rights-of-way acquired or to be acquired by the local organization for such reservoir or other area, and (b) minimum basic facilities needed for public health and safety, access to, and use of such reservoir or other area for such purposes: Provided further, That the Secretary shall be authorized to participate in recreational development in any watershed project only to the extent that the need therefor is demonstrated in accordance with standards established by him, taking into account the anticipated man-days of use of the projected recreational development and giving consideration to the availability within the region of existing water-based outdoor recreational developments: Provided further, That the Secretary shall be authorized to participate in not more than one recreational development in a watershed project containing less than seventy-five thousand acres, or two such developments in a project containing between seventy-five thousand and one hundred and fifty thousand acres, or three such developments in projects exceeding one hundred and fifty thousand acres: Provided further, That when the Secretary and a local organization have agreed that the immediate acquisition by the local organization of land, easements, or rights-of-way is advisable for the preservation of sites for works of improvement included in a plan from encroachment by residential, commercial, industrial, or other development, the Secretary shall be authorized to advance to the local organization from funds appropriated for construction of works of improvement the amounts required for the acquisition of such land, easements or rights-of-way; and, except where such costs are to be borne by the Secretary, such advance shall be repaid by the local organization, with interest, prior to construction of the works of improvement, for credit to such construction funds.

(2) assume (A) such proportionate share, as is determined by the Secretary to be equitable in consideration of national needs and assistance authorized for similar purposes under other Federal programs, of the costs of installing any works of improvement, involving Federal assistance (excluding engineering costs), which is applicable to the agricultural phases of the conservation, development, utilization, and disposal of water or for fish and wildlife or recreational development, and (B) all of the cost of installing any portion of such works applicable to other purposes except that any part of the construction cost (including engineering costs) applicable to flood prevention and features relating thereto shall be borne by the Federal Government and paid for by the Secretary out of funds appropriated for the purposes of this Act: Provided, That, in addition to and without limitation on the authority of the Secretary to make loans or advancements under section 8, the Secretary may pay for any storage of water for anticipated future demands or needs for municipal or industrial water included in any reservoir structure constructed or modified under the provisions of this Act not to exceed 30 per centum of the total estimated cost of such reservoir structure where the local organization gives reasonable assurances, and there is evidence, that such demands for the use of such storage will be made within a period of time which will permit repayment of the cost of such water supply storage within the life of the reservoir structure: Provided further, That the local organization shall agree prior to initiation of construction or modification of any reservoir structure including such water supply storage to repay the cost of such water supply storage for anticipated future demands: And provided further, That the entire amount of the cost paid by the Secretary for such water supply storage for anticipated future demands shall be repaid within the life of the reservoir structure but in no event to exceed fifty years after the reservoir structure is first used for the storage of water for water supply purposes, except that (1) no repayment of the cost of such water supply storage for anticipated future demands need be made until such supply is first used, and (2) no interest shall be charged on the cost of such water supply storage for anticipated future demands until such supply is first used, but in no case shall the interest-free period exceed ten years. The interest rate used for purposes of computing the interest on the unpaid balance shall be determined in accordance with the provisions of section 8.

(3) make arrangements satisfactory to the Secretary for defraying costs of operating and maintaining such works of improvement, in accordance with regulations presented by the Secretary of Agriculture.

(4) acquire, or provide assurance that landowners or water users have acquired, such water rights, pursuant to State law, as may be needed in the installation and operation of the work of improvement.

(5) obtain agreements to carry out recommended soil conservation measures and proper farm plans from owners of not less than 50 per centum of the lands situated in the drainage area above each retention reservoir to be installed with Federal assistance; and

(6) submit a plan of repayment satisfactory to the Secretary for any loan or advancement made under the provisions of section 8.

SEC. 5. (1) At such time as the Secretary and the interested local organization have agreed on a plan for works of improvement, and the Secretary has determined that the benefits exceed the costs, and the local organization has met the requirements for participation in carrying out the works of improvement as set forth in section 4, the local organization may secure engineering and other services, including the design, preparation of contracts and specifications, awarding of contracts, and supervision of construction, in connection with such works of improvement, by retaining or employing a professional engineer

or engineers satisfactory to the Secretary or may request the Secretary to provide such services: Provided, That if the local organization elects to employ a professional engineer or engineers, the Secretary shall reimburse the local organization for the costs of such engineering and other services secured by the local organization as are properly chargeable to such works of improvement in an amount not to exceed the amount agreed upon in the plan for works of improvement or any modification thereof: Provided further, That the Secretary may advance such amounts as may be necessary to pay for such services, but such advances with respect to any works of improvement shall not exceed 5 per centum of the estimated installation cost of such works.

(2) Except as to the installation of works of improvement on Federal lands, the Secretary shall not construct or enter into any contract for the construction of any structure.

(3) Whenever the estimated Federal contribution to the construction cost of works of improvement in the plan for any watershed or subwatershed area shall exceed \$250,000 or the works of improvement include any structure having a total capacity in excess of twenty-five hundred acre-feet, the Secretary shall transmit a copy of the plan and the justification therefor to the Congress through the President.

(4) Any plan for works of improvement involving an estimated Federal contribution to construction costs in excess of \$250,000 or including any structure having a total capacity in excess of twenty-five hundred acre-feet (a) which includes reclamation or irrigation works or which affects public or other lands or wildlife under the jurisdiction of the Secretary of the Interior, (b) which includes Federal assistance for floodwater detention structures, shall be submitted to the Secretary of the Interior or the Secretary of the Army, respectively, for his views and recommendations at least thirty days prior to transmission of the plan to the Congress through the President. The views and recommendations of the Secretary of the Interior, and the Secretary of the Army, if received by the Secretary prior to the expiration of the above thirty-day period, shall accompany the plan transmitted by the Secretary to the Congress through the President.

(5) Prior to any Federal participation in the works of improvement under this act, the President shall issue such rules and regulations as he deems necessary or desirable to carry out the purposes of this Act, and to assure the coordination of the work authorized under this Act and related work of other agencies, including the Department of the Interior and the Department of the Army.

SEC. 6. The Secretary is authorized in cooperation with other Federal and with States and local agencies to make investigations and surveys of the watersheds of rivers and other waterways as a basis for the development of coordinated programs. In areas where the programs of the Secretary of Agriculture may affect public or other lands under the jurisdiction of the Secretary of the Interior, the Secretary of the Interior is authorized to cooperate with the Secretary of Agriculture in the planning and development of works or programs for such lands.

SEC. 7. The provisions of the Act of June 22, 1936 (49 Stat. 1570), as amended and supplemented, conferring authority upon the Department of Agriculture under the direction of the Secretary of Agriculture to make preliminary examinations and surveys and to prosecute works of improvement for runoff and waterflow retardation and soil erosion prevention on the watersheds of rivers and other waterways are hereby repealed: Provided, That (a) the authority of that Department of Agriculture, under the direction of the Secretary, to prosecute the works of improvement for runoff and waterflow retardation and soil erosion prevention authorized to be carried out by the Department by the Act of December 22, 1944 (58 Stat. 887), as amended, and (b) the authority of the Secretary of Agriculture to undertake emergency measures for runoff retardation and soil

erosion prevention authorized to be carried out by section 7 of the Act of June 28, 1938 (52 Stat. 1215), as amended by section 216 of the Act of May 17, 1950 (64 Stat. 163), shall not be affected by the provisions of this section: Provided further, That in connection with the eleven watershed improvement programs authorized by section 13 of the Act of December 22, 1944 (58 Stat. 887), as amended and supplemented, the Secretary of Agriculture is authorized to prosecute additional works of improvement for the conservation, development, utilization, and disposal of water in accordance with the provisions of section 4 of this Act or any amendments hereafter made thereto.

SEC. 8. The Secretary is authorized to make loans or advancements (a) to local organizations to finance the local share of costs of carrying out works of improvement provided for in this Act, and (b) to State and local agencies to finance the local share of costs of carrying out works of improvement (as defined in section 2 of this Act) in connection with the eleven watershed improvement programs authorized by section 13 of the Act of December 22, 1944 (58 Stat. 887), as amended and supplemented: Provided, That the works of improvement in connection with said eleven watershed improvement programs shall be integral parts of watershed or subwatershed work plans agreed upon by the Secretary of Agriculture and the concerned State and local agencies. Such loans or advancements shall be made under contracts or agreements which will provide, under such terms and conditions as the Secretary deems appropriate, for the repayment thereof in not more than fifty years from the date when the principal benefits of the works of improvement first become available, with interest at the average rate, as determined by the Secretary of the Treasury, payable by the Treasury upon its marketable public obligations outstanding at the beginning of the fiscal year in which the loan or advancement is made, which are neither due nor callable for redemption for fifteen years from date of issue. With respect to any single plan for works of improvement, the amount of any such loan or advancement shall not exceed five million dollars.

SEC. 9. The provisions of this Act shall be applicable to Hawaii, Alaska, Puerto Rico, and the Virgin Islands.

SEC. 10. There are hereby authorized to be appropriated such sums as may be necessary to carry out the purposes of this Act, such sums to remain available until expended. No appropriation hereafter available for assisting local organizations in preparing and carrying out plans for works of improvement under the provisions of section 3 or clause (a) of section 8 of this Act shall be available for any works of improvement pursuant to this Act or otherwise in connection with the eleven watershed improvement programs authorized by section 13 of the Act of December 22, 1944 (58 Stat. 887), as amended and supplemented, or for making loans or advancements to State and local agencies as authorized by clause (b) of section 8.

SEC. 11. This Act may be cited as the "Watershed Protection and Flood Prevention Act."

SEC. 12. When the Secretary approves the furnishing of assistance to a local organization in preparing a plan for works of improvement as provided for in section 3:

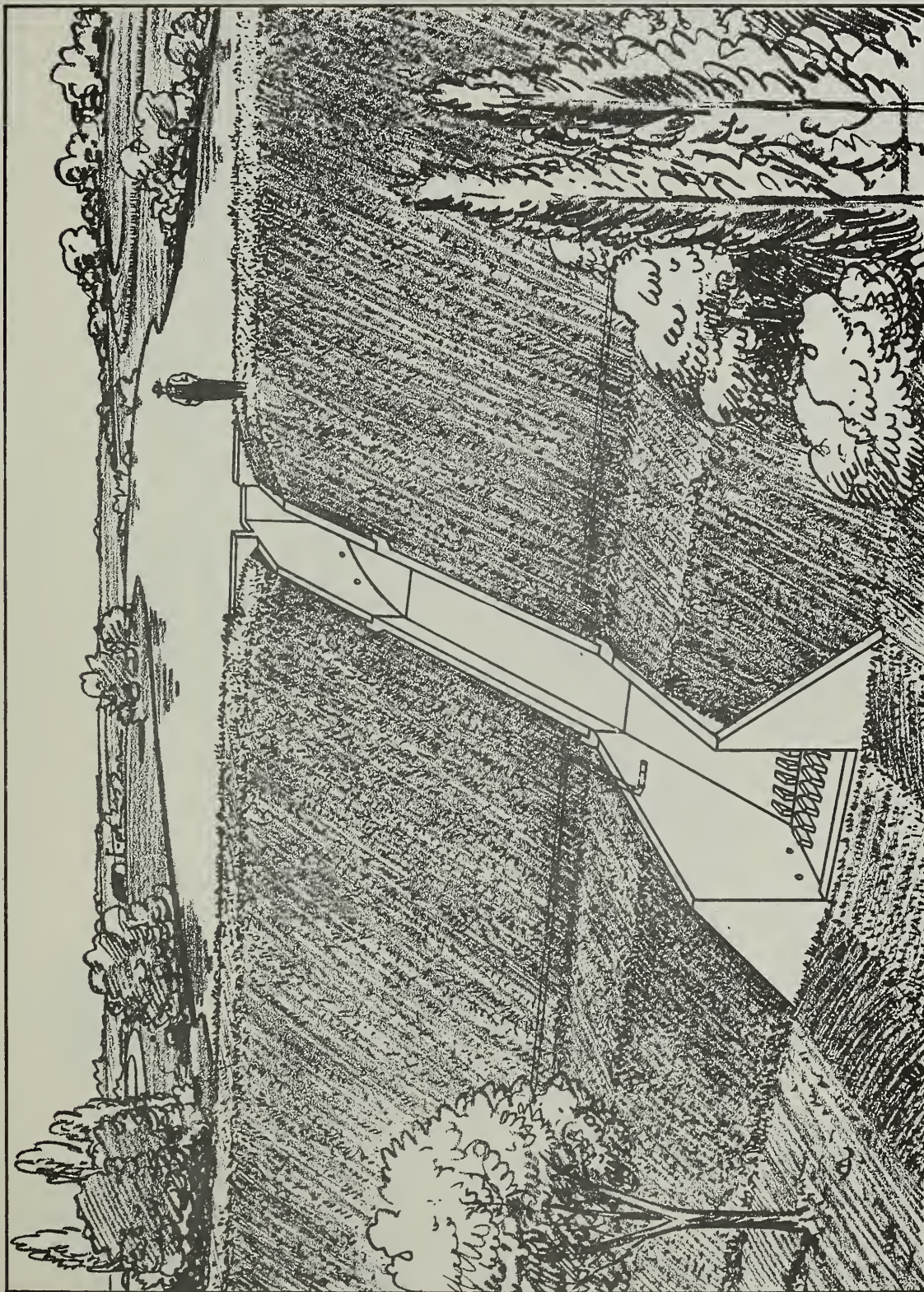
(1) The Secretary shall so notify the Secretary of the Interior in order that the latter, as he desires, may make surveys and investigations and prepare a report with recommendations concerning the conservation and development of wildlife resources and participate, under arrangements satisfactory to the Secretary of Agriculture, in the preparation of a plan for works of improvement that is acceptable to the local organization and the Secretary of Agriculture.

(2) Full consideration shall be given to the recommendations contained in any such report of the Secretary of the Interior as he may submit to the Secretary of Agriculture prior to the time the local

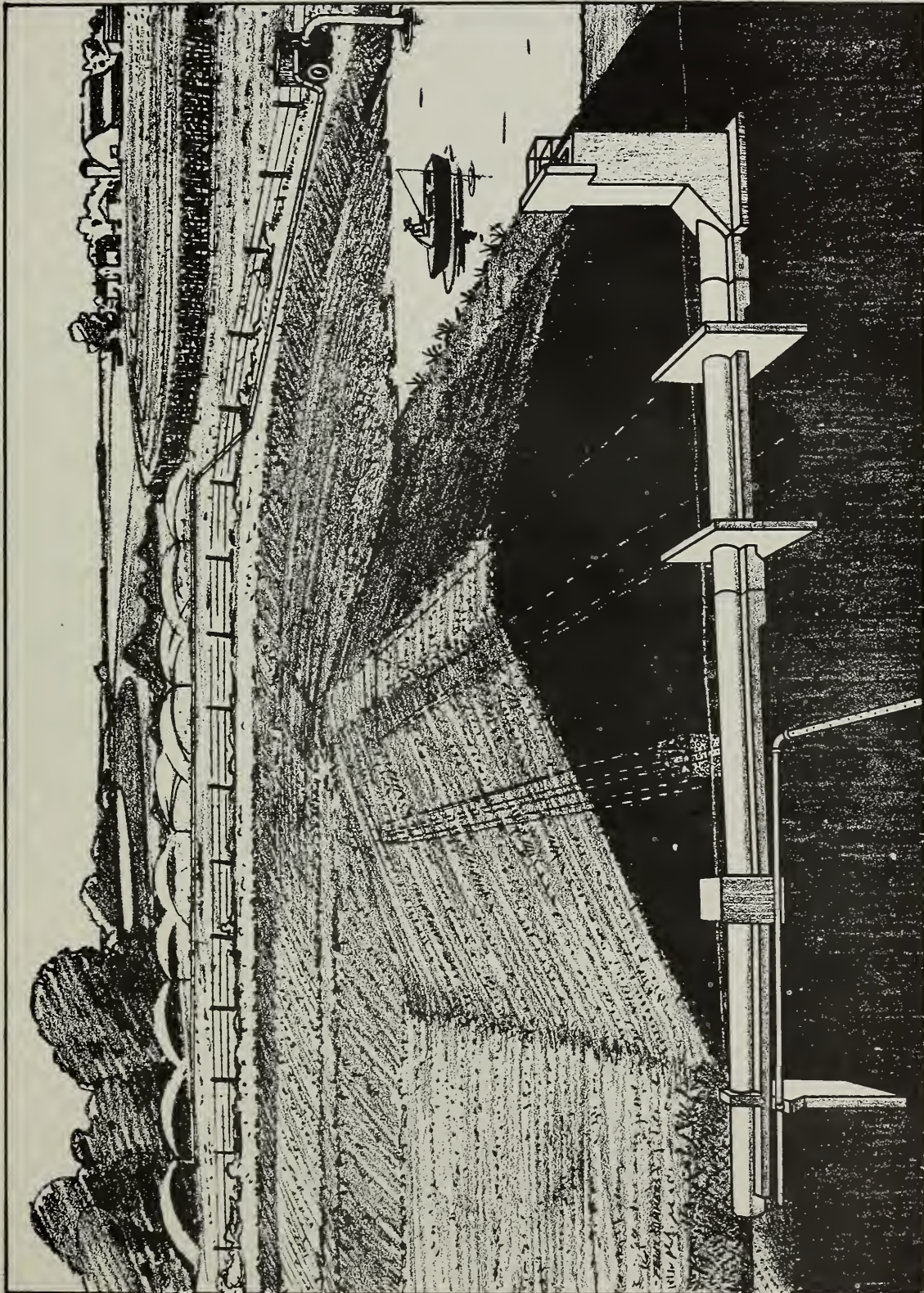
organization and the Secretary of Agriculture have agreed on a plan for works of improvement. The plan shall include such of the technically and economically feasible works of improvement for wildlife purposes recommended in the report by the Secretary of the Interior as are acceptable to, and agreed to by, the local organization and the Secretary of Agriculture, and such report of the Secretary of the Interior shall, if requested by the Secretary of the Interior, accompany the plan for works of improvement when it is submitted to the Secretary of Agriculture for approval or transmitted to the Congress through the President.

(3) The cost of making surveys and investigations and of preparing reports concerning the conservation and development of wildlife resources shall be borne by the Secretary of the Interior out of funds appropriated to his Department.

As amended September 27, 1962 and November 8, 1965.



Chute Spillway



Earthfill dam with concrete drop-inlet and irrigation reservoir.

Recreation Facilities Installation Cost

MERAMEC RIVER BASIN, MISSOURI

Structure No.	Cost (Dollars)	Structure No.	Cost (Dollars)
AN- 2	68,400	GR-10	97,400
BC- 2	138,700	H -25	741,500
BC- 3	143,000	HC-20	424,700
BN-12	106,900	HZ-20b	325,300
BZ-20	168,500	HZ-22	377,500
CA-13	86,600	HZ-24a	338,700
CA-14	84,300	HZ-26	168,500
CC- 1	274,700	HZ-28	441,600
CC- 2	310,100	KR-10	86,600
CC-20	176,900	LB-10	196,400
CC-22	94,400	LF-12	191,900
CC-24	99,000	LM-10	107,100
CL-12	169,000	LM-12	107,100
CT-20a	283,100	LP-10	102,300
CT-22b	170,200	PL-12	126,700
CT-25	217,400	PR-12	144,600
CT-26a	682,600	RO- 9	116,900
CT-27	156,700	SD-10	92,800
CT-29	355,600	SO-10	146,200
CT-34	325,300	TM-12	113,700
DC- 1	119,500	UB-12	322,200
FW-20	106,100	UM-26a	377,500
FX- 2	84,300	UP-10	102,300

BASIN TOTAL

9,670,800

Structure Installation Costs
MERAMEC RIVER BASIN, MISSOURI

Structure No.	Purpose		Total
	Flood Prevention (Dollars)	Recreation (Dollars)	
AN- 1	250,190		250,190
AN- 2	49,000	229,000	278,000
BC- 2	300,000	853,000	1,153,000
BC- 3	205,000	744,000	949,000
BN-12	196,820	147,180	344,000
BR-10	154,000		154,000
BZ-20		170,000	170,000
CA-10	153,000		153,000
CA-13	141,000	141,000	282,000
CA-14	106,000	119,000	225,000
CC- 1		209,000	209,000
CC- 2		221,000	221,000
CC-20	196,700	202,300	399,000
CC-22	93,500	150,500	244,000
CC-24	139,400	163,600	303,000
CL-12	178,620	169,380	348,000
CT-20a		209,000	209,000
CT-22b		200,000	200,000
CT-25		210,000	210,000
CT-26a		360,000	360,000
CT-27		170,000	170,000
CT-29		250,000	250,000
CT-34		260,000	260,000
DC- 1	198,100	184,400	382,500
DF-11	284,000		284,000
DF-20	227,000		227,000
DF-22	157,000		157,000
DF-24	135,000		135,000
DF-26	143,000		143,000
DF-28	238,000		238,000
DV-20	236,000		236,000
FW-20	126,000	151,000	277,000
FX- 1	325,000		325,000
FX- 2	146,500	230,000	376,500
GR-10	105,970	100,030	206,000
H -25		500,000	500,000
HC-20	124,400	183,600	308,000
HZ-20b		267,000	267,000
HZ-22		299,000	299,000
HZ-24a		259,000	259,000

Structure Installation Costs
MERAMEC RIVER BASIN, MISSOURI

(Continued)

Structure No.	Purpose		Total
	Flood Prevention (Dollars)	Recreation (Dollars)	
HZ-26		200,000	200,000
HZ-28		297,000	297,000
KR-10	109,850	89,150	199,000
LB-10	184,130	175,370	359,500
LC-14	196,000		196,000
LF-12	171,550	196,950	368,500
LM-10	121,500	121,500	243,000
LM-12	189,000	120,000	309,000
LP-10	104,700	111,300	216,000
PL-12	127,430	144,570	272,000
PR-12	139,550	163,450	303,000
RO- 9	123,350	139,650	263,000
SD-10	109,450	106,550	216,000
SO-10	149,190	178,810	328,000
TM-12	128,550	131,950	260,500
UB-12	215,100	304,900	520,000
UM-23	300,000		300,000
UM-26a	51,500	231,500	283,000
UP-10	96,470	136,530	233,000
WA-12	180,000		180,000
TOTAL	7,306,520	10,201,170	17,507,690

Single Purpose and Multipurpose Structure Data
MERAMEC RIVER BASIN, MISSOURI

Structure No.	Drainage Area Sq. Mi.	Storage Volume		Maximum Pool Area (Acres)	Maximum Fill Height (Feet)	Approx. Elev. Top of Dam (MSL-Ft.)
		Flood Prevent. (Ac. Ft.)	Recreation (Ac. Ft.)			
AN- 1	2.0	780		780	55	645
AN- 2	1.0	239	1,132	1,371	60	690
BC- 2	7.7		5,242	7,069	70	615
BC- 3	7.0	1,827	6,010	7,680	65	545
BN-12	21.1	1,670	3,551	8,300	60	823
BR-10	6.4	4,749		1,603	57	840
BZ-20	5.9	1,603	1,740	1,740	44	
CA-10	5.8	1,600		1,600	63	1,057
CA-13	4.4	1,198	1,200	2,398	40	635
CA-14	3.7	1,004	1,124	2,128	50	632
CC- 1	4.7		2,858	3,208	50	568
CC- 2	4.0		3,208	11,693	67	1,199
CC-20	23.5	6,720	4,973	3,929	66	1,191
CC-22	6.6	1,724	2,205	4,619	67	1,099
CC-24	8.3	2,485	2,134	8,510	61	1,038
CL-12	18.2	4,368	4,142	2,852	66	984
CT-20a	10.6		2,852	2,320	50	910
CT-22b	7.3		2,320	2,550	63	1,055
CT-25	11.0		2,550	8,330	64	1,038
CT-26a	33.2		8,330	1,693	66	1,025
CT-27	4.7		1,693	3,840	64	864
CT-29	16.9		3,840	4,214	69	1,015
CT-34	9.8		4,214	5,000	65	965
DC- 1	9.2		2,410	5,400	75	811
DF-11	18.5	2,590		7,834	45	635
DF-20	33.4	5,400		4,836	45	966
DF-22	20.7	7,834		3,232	50	1,180
DF-24	13.8	4,836		3,210	46	1,160
DF-26	13.7	3,232		10,152	37	1,172
DF-28	43.3	3,210		3,680	50	1,135
DV-20	16.8	10,152		5,141	55	1,102
FW-20	9.6	3,680	2,381	5,141	64	1,185
		2,760				1,048

Single Purpose and Multipurpose Structure Data

MERAMEC RIVER BASIN, MISSOURI

(Continued)

Structure No.	Drainage Area Sq. Mi.	Flood Prevent. (Ac. Ft.)	Storage Volume Recreation (Ac. Ft.)	Total (Ac. Ft.)	Maximum Pool Area (Acres)	Maximum Fill Height (Feet)	Approx. Elev. Top of Dam (MSL-Ft.)
FX- 1	5.9	1,590	1,428	1,590	93	60	573
FX- 2	3.8	908	1,345	2,336	128	65	611
GR-10	6.2	1,425	14,658	2,770	126	45	896
H -25	13.3	2,590	3,825	6,415	620	105	1,105
HC-20	12.6		3,702	3,702	262	55	1,142
HZ-20b	27.8		4,840	4,840	306	63	1,015
HZ-22	27.2		4,860	4,860	255	65	995
HZ-24a	15.4		2,252	2,252	136	75	985
HZ-26	7.9		5,548	5,548	359	67	1,079
HZ-28	20.0		1,163	2,593	156	48	875
KR-10	6.2	1,430	4,488	9,174	615	47	736
LB-10	20.2	4,686		2,486	164	47	858
LC-14	9.0	2,486		9,750	590	57	519
LF-12	23.0	4,539	5,211	4,740	247	59	978
LM-10	8.6	2,370	2,370	5,089	275	60	631
LM-12	11.3	3,105	1,984	3,041	226	44	652
LP-10	6.9	1,474	1,567	4,950	300	53	956
PL-12	9.8	2,319	2,631	6,236	380	50	877
PR-12	12.6	2,872	3,364	5,204	256	55	863
RO- 9	9.6	2,440	2,764	3,034	177	57	871
SD-10	5.6	1,538	1,496	7,429	400	57	817
SO-10	13.9	3,447	3,982	4,521	269	61	763
TM-12	8.9	2,231	2,290	20,918	1,090	59	792
UB-12	43.9	8,653	12,265	6,080	430	45	911
UM-23	29.5	6,080	4,394	5,370	255	68	1,161
UM-26a	5.2	976	2,096	3,577	222	51	1,240
UP-10	6.9	1,481		2,122	156	49	975
WA-12	8.5	2,122					858
TOTAL	782.5	134,423	164,632	299,055	17,964		

Recreation Structure Data

MERAMEC RIVER BASIN, MISSOURI

Structure No.	Recreation Pool Area (Acres)	Depth of Pool (Feet)	Shoreline (Miles)	Land for Facilities (Acres)	Annual Capacity (Recr.-Days)	Time Zone (Hours)
AN- 2	51	60	1.8	72	36,400	$\frac{1}{2}$ -1
BC- 2	267	54	7.2	288	106,000	1
BC- 3	280	46	8.2	328	110,200	1
BN-12	335	41	8.7	348	100,100	1
BZ-20	100	48	3.4	135	52,000	2
CA-13	107	35	3.5	140	54,500	1
CA-14	100	36	3.3	132	52,200	1
CC- 1	163	52	5.4	217	72,000	2
CC- 2	184	51	6.0	242	79,000	2
CC-20	384	43	6.9	276	143,700	2
CC-22	131	43	3.5	140	62,200	2
CC-24	145	46	3.6	144	66,700	2
CL-12	360	32	8.3	332	136,000	2
CT-20a	168	48	5.2	209	74,000	$\frac{1}{2}$ -2
CT-22b	101	59	4.7	188	52,000	2
CT-25	129	51	4.4	175	62,000	2
CT-26a	405	49	8.4	337	150,000	2
CT-27	93	54	4.3	171	50,000	2
CT-29	211	50	7.8	310	88,000	2
CT-34	193	60	6.2	249	82,000	2
DC- 1	208	40	5.4	216	87,000	1
FW-20	167	44	3.7	148	73,800	2
FX- 2	100	50	3.4	136	52,200	$\frac{1}{2}$ -1
GR-10	140	31	4.8	192	65,100	$\frac{1}{2}$ -2
H -25	440	100	13.3	532	162,000	2

Recreation Structure Data
MERAMEC RIVER BASIN, MISSOURI
(Continued)

Structure No.	Recreation Pool Area (Acres)	Depth of Pool (Feet)	Shoreline (Miles)	Land for Facilities (Acres)	Annual Capacity (Recr.-Days)	Time Zone (Hours)
HC-20	252	40	8.1	324	101,000	2 $\frac{1}{2}$ -3
HZ-20b	193	48	6.9	275	82,000	2 $\frac{1}{2}$ -3
HZ-22	224	50	6.6	262	92,000	2 $\frac{1}{2}$ -3
HZ-24a	201	60	5.5	221	85,000	2 $\frac{1}{2}$ -2 $\frac{1}{2}$
HZ-26	100	52	4.6	183	52,000	2 $\frac{1}{2}$ -2 $\frac{1}{2}$
HZ-28	262	52	7.8	313	104,000	2 $\frac{1}{2}$ -2 $\frac{1}{2}$
KR-10	107	30	4.8	192	54,500	1 $\frac{1}{2}$ -2
LB-10	444	33	8.5	340	161,800	1 $\frac{1}{2}$ -1 $\frac{1}{2}$
LF-12	430	40	8.8	350	191,800	2 $\frac{1}{2}$ -2 $\frac{1}{2}$
LM-10	170	42	4.8	192	74,800	1 $\frac{1}{2}$ -1 $\frac{1}{2}$
LM-12	170	40	4.9	196	74,800	1 $\frac{1}{2}$ -1 $\frac{1}{2}$
LP-10	155	28	5.1	204	70,000	1 $\frac{1}{2}$ -2
PL-12	230	39	6.0	240	94,100	1 $\frac{1}{2}$ -2
PR-12	285	38	6.8	272	111,800	1 $\frac{1}{2}$ -2
RO-9	200	40	6.0	240	88,100	1 $\frac{1}{2}$ -2
SD-10	126	37	4.6	185	54,100	1 $\frac{1}{2}$ -2
SO-10	290	42	7.1	284	113,400	1 $\frac{1}{2}$ -2
TM-12	190	46	5.8	232	81,200	1 $\frac{1}{2}$ -1 $\frac{1}{2}$
UB-12	830	44	12.8	512	287,000	1 $\frac{1}{2}$ -2
UM-26a	224	57	5.5	220	92,000	2 $\frac{1}{2}$ -3
UP-10	155	37	5.1	204	70,000	1 $\frac{1}{2}$ -2
TOTAL	10,200		277.5	11,098	4,204,500	

Annual Structure Costs
MERAMEC RIVER BASIN, MISSOURI

Structure No.	Flood Prevention (Dollars)	Recreation (Dollars)	Total (Dollars)
AN- 1	8,490		8,490
AN- 2	1,670	7,860	9,530
BC- 2	10,180	28,700	38,880
BC- 3	8,550	23,450	32,000
BN-12	6,740	5,050	11,790
BR-10	5,280		5,280
BZ-20		5,560	5,560
CA-10	5,300		5,300
CA-13	4,750	4,750	9,500
CA-14	3,540	3,960	7,500
CC- 1		6,850	6,850
CC- 2		7,240	7,240
CC-20	7,750	7,970	15,720
CC-22	3,010	4,840	7,850
CC-24	4,420	5,180	9,600
CL-12	6,110	5,810	11,920
CT-20a		6,850	6,850
CT-22b		6,540	6,540
CT-25		6,900	6,900
CT-26a		12,100	12,100
CT-27		5,560	5,560
CT-29		8,180	8,180
CT-34		8,420	8,420
DC- 1	6,700	6,240	12,940
DF-11	9,730		9,730
DF-20	7,660		7,660
DF-22	5,330		5,330
DF-24	4,590		4,590
DF-26	4,700		4,700
DF-28	8,010		8,010
DV-20	7,600		7,600
FW-20	4,200	5,030	9,230
FX- 1	10,860		10,860
FX- 2	5,050	7,950	13,000
GR-10	3,630	3,430	7,060
H -25		16,500	16,500
HC-20	4,240	6,260	10,500
HZ-20b		9,060	9,060
HZ-22		9,780	9,780
HZ-24a		8,450	8,450

Annual Structure Costs
MERAMEC RIVER BASIN, MISSOURI

(Continued)

Structure No.	Flood Prevention	Recreation	Total
	(Dollars)	(Dollars)	(Dollars)
HZ-26		6,540	6,540
HZ-28		9,650	9,650
KR-10	3,760	3,060	6,820
LB-10	6,300	6,020	12,320
LC-14	6,550		6,550
LF-12	5,880	6,740	12,620
LM-10	4,150	4,150	8,300
LM-12	6,480	4,110	10,590
LP-10	3,590	3,810	7,400
FL-12	4,360	4,960	9,320
PR-12	4,780	5,600	10,380
RO- 9	4,220	4,780	9,000
SD-10	3,750	3,650	7,400
SO-10	5,220	6,020	11,240
TM-12	4,400	4,520	8,920
UB-12	7,380	10,440	17,820
UM-23	11,600		11,600
UM-26a	1,720	7,730	9,450
UP-10	3,300	4,680	7,980
WA-12	6,170		6,170
Basin Total	251,700	340,930	592,630

WATERS OF THE MERAMEC.

Enough good water is important to everyone whether he lives in the city or on a farm.

A dependable supply of high quality water is essential to the growth of communities and to the well-being of their people.

WATERSHEDS

The watersheds in the Meramec River Basin are unique in the area in that they have for the most part clear running streams. In order to keep the quality of this water high, farms, forests and other lands must have conservation use and care to reduce erosion and to protect the streams and reservoirs from silt damage.

Sixty reservoirs in the Basin are proposed for watershed protection and recreation. Some storage will be available in the reservoirs for community water supply, for irrigation, and for fish and wildlife uses as needed.

RECREATION

Forty-eight of the reservoirs will provide about 11,000 surface acres for much-needed water-based recreation -- fishing, swimming, boating, water-skiing, camping and picnicking.

The shorelines of these reservoirs will total about 280 miles.

FLOOD DAMAGE REDUCTION

Forty-two of the reservoirs will provide for reducing flood damage on over 36,000 acres of valuable flood-plain land along the Basin's streams, most of it along tributaries.

These lands are important to the efficient operation of many of the farms. Floods have been occurring almost every year, causing damage to land, crops, livestock, equipment and roads.

CONSERVATION OF SOIL AND WATER

The conservation use and treatment of the land and water in the Basin are important in the development of agricultural resources. Well-planned and applied conservation will be an essential step in this development. It will insure a continuing supply of good-quality water and prevent silt damage to the streams and reservoirs.

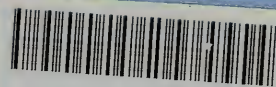


For the future: more of these in the Basin

WATER DEVELOPMENT

NO.	STRUCTURE NAME	AREA	RECREATION POOL	SHORELINE
		(SQ. MI.)	ACRES	(MILES)
AN- 1	Antire Creek	2	-	-
AN- 2	Little Antire Creek	1	51	1.8
BC- 2	Belews Creek	8	267	7.2
BC- 3	Regma Br. of Belews Crk.	7	280	8.2
BN-12	Boone Creek	21	335	8.7
BR-10	Brush Creek of Dry Fork Br.	6	-	-
BZ-20	Brazil Creek	6	100	3.4
CA-10	Calvey Creek (West Fork)	6	-	-
CA-13	Calvey Creek	4	107	3.5
CA-14	Calvey Creek (Side Hollow)	4	100	3.3
CC- 1	Crooked Creek (East Prong)	5	163	5.4
CC- 2	Crooked Creek (Middle Prong)	4	184	6.0
CC-20	Crooked Creek	24	384	6.9
CC-22	Crooked Creek (Side Hollow)	7	131	3.5
CC-24	Crooked Creek, Yankee Br.	8	145	3.6
CL-12	Clear Crk. of Upper Bour.	18	360	8.3
CT-20a	Courtois Creek	11	168	5.2
CT-22b	Courtois, Ind. Crk. Br.	7	101	4.7
CT-25	Courtois, Cub Creek Br.	11	129	4.4
CT-26a	Courtois, Hazel Creek	33	405	8.4
CT-27	Courtois, Trace Creek	5	93	4.3
CT-29	Courtois, Upper Hazel Crk.	17	211	7.8
CT-34	Courtois, Billy's Branch	10	193	6.2
DC- 1	Dry Creek	9	208	5.4
DF-11	Dry Fork Br. of Bour. Riv.	19	-	-
DF-20	Dry Fork	33	-	-
DF-22	Dry Fork, Barnett Prong	21	-	-
DF-24	Dry Fork, Holt Creek	14	-	-
DF-26	Dry Fork, Elk Hollow	14	-	-
DF-28	Dry Fork, Spring Creek	43	-	-
DV-20	Dry Valley Creek	17	-	-
FW-20	Fishwater Creek	10	167	3.7
FX- 1	Fox Creek	6	-	-
FX- 2	Little Fox Creek	4	100	3.4
GR-10	Greedy Creek of Dry Fork Br.	6	140	4.8
H-25	Upper Big River, Teller Br.	13	440	13.3
HC-20	Hutchins Creek	13	252	8.1
HZ-20b	East Fork Huzzah	28	193	6.9
HZ-22	West Fork Huzzah	27	224	6.6
HZ-24a	Crooked Creek of Huzzah	15	201	5.5
HZ-26	Indian Creek of Huzzah	8	100	4.6
HZ-28	Shoal Creek of Huzzah	20	262	7.8
KR-10	Kriete Creek	6	107	4.8
LB-10	Little Bourbeuse River	20	444	8.5
LC-14	Little Calvey Creek	9	-	-
LF-12	Lanes Fork	23	430	8.8
LM-10	Little Meramec River	9	170	4.8
LM-12	West Fork Little Meramec	11	170	4.9
LP-10	Lower Peavine	7	155	5.1
PL-12	Pleasant Valley	10	230	6.0
PR-12	Prairie Creek	13	285	6.8
RO- 9	Red Oak Creek	10	200	6.0
SD-10	Souder Creek	6	126	4.6
SO-10	Soap Creek	14	290	7.1
TM-12	Threemile Creek	9	190	5.8
UB-12	Upper Bourbeuse River	44	830	12.8
UM-23	Upper Meramec River	30	-	-
UM-26a	Stone Hill Branch	5	224	5.5
UP-10	Upper Peavine	7	155	5.1
WA-12	Wallace Creek	8	-	-

A study by the U. S. Department of Agriculture has revealed the needs and opportunities for land and water development in the Meramec River Basin. The study, by the Soil Conservation Service, Forest Service, Economic Research Service and other federal agencies with the help of state and local interests, was under the sponsorship of the Water Resources Board of Missouri. It complements a related study by the U. S. Army Corps of Engineers which proposes several dams on major streams and tributaries for flood control, water quality and supply, and for recreation.



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Where there's water, the outdoors beckons



Industry -- Looks to the basin resources

THE MANY USES OF OUR RIVER BASIN

The Meramec River Basin is rich in the story of men and the land.

Its history recalls the Indian, the explorer, the trapper, the miner, the logger, the farmer and the industrialist. It is a story of development and growth, exploitation and abuse, interest and apathy.

The forests, the farms, the water, the wildlife -- all of these are the heritage of everyone. But these assets can deteriorate, or stagnate. Or they can grow in usefulness.

These valued resources can be developed through the efforts of the people who live in the Basin, with the help of the cooperative programs of the United States Department of Agriculture.



USES OF OUR LAND

The Meramec River Basin's 2,500,000 acres is one-fifth cropland nearly three-fifths forests, and the rest is in pasture and other uses.

More and more of the land in farms and forests is used each year to meet the needs of a growing population for homes, highways and institutions.

Most of the land is gently to steeply rolling with narrow valleys along the streams. Hardwood forests, with occasional scattering of pine, cover much of the rolling landscape. Open areas of grass and other vegetation are used for meadow and pasture. The bottomlands are used mostly for grain and hay for livestock.

About 40,000 acres are primarily in recreation use.

The conservation treatment and use of all of the land and water in the Basin is essential for its continuing usefulness to an expanding population.

RECREATION

The need for outdoor recreation, long an important use of the Meramec River Basin, is increasing at a spectacular rate.

Natural characteristics of the Basin make it particularly inviting for development of outdoor recreation. Few areas of the nation have such concentrations of recreation users so near at hand, and the population in and near the Basin is expected to increase rapidly in the next few years.

With the increase in population, income, leisure and mobility, there exists an increasing demand for recreation development which is equaled by few areas in the country.

Studies reveal a potential of \$25,000,000 to \$30,000,000 in annual income for the Basin from recreational development. The figures can be expected to double by the year 2010.

The future of recreation use of the Basin will be governed largely by public decisions concerning the development of the water resources.

FORESTS

Historically the forest resources have been a valuable asset to the people living in and near the Basin. Today these resources, under private, state and federal ownership, are in a varying degree of productivity.

Some of the owners of forest lands have shown how stewardship and management enhance their usefulness to the people, but there is still much to be done. Forest industries need an assured supply of quality timber.

People seeking recreation in the forest will return to the areas they have enjoyed. Fish and wildlife will thrive under proper forest conditions. Surface waters in a forest setting are in great demand.

The forest watersheds will protect and improve the soil and water conditions under good management. The development of healthy forest resources can meet the future needs of individuals, communities, the nation and of generations that follow.



Water in a natural setting -- folks love it

AGRICULTURE

About a million acres in the Meramec Basin are in crops and livestock use.

The Basin need for these products, however, is greater than production with the present level of use and management.

A complete agricultural plan, with emphasis on soil and water conservation, can bring about protection from flood damage, stop the erosion of useful land and increase income through efficient management of these resources.

Such a plan would encourage development of the Basin's agricultural resources and provide for a higher level of long-term benefits to the people of the Basin, to adjoining communities, and to the nation.



Valley agriculture -- grass and cattle



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